

**Project Manual
for**

Pope's Tavern

ADDITION/RENOVATION

Halifax, Massachusetts

prepared by:

Winslow Architects, Inc.
89 Massachusetts Avenue
Arlington, Massachusetts 02474

Date of Issue:

July 11, 2018

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July 11, 2018

POPE'S TAVERN
ADDITION/RENOVATION
Halifax, Massachusetts

PROJECT DIRECTORY

OWNER

Town of Halifax
499 Plymouth Street
Halifax, Massachusetts 02338

CONSTRUCTION MANAGER / GENERAL CONTRACTOR

Vertex
400 Libbey Parkway
Weymouth, Massachusetts 02189

ARCHITECT

Winslow Architects, Inc.
89 Massachusetts Avenue
Arlington, Massachusetts 02474

CONSULTANTS

CIVIL ENGINEERING

Webby Engineering Associates, Inc.
180 County Road
Plympton, Massachusetts 02367

STRUCTURAL ENGINEERING

Michael E. Waterman, P.E.
2A Austin Kelly Lane
Southborough, Massachusetts 01772

MECHANICAL, ELECTRICAL, PLUMBING, AND FIRE PROTECTION ENGINEERING

MacRitchie Engineering, Inc.
197 Quincy Avenue
Braintree, Massachusetts 02184

SPECIFICATIONS CONSULTANT

Wil-Spec LLC
Lynnfield Medical Office Building
15 Post Office Square
Lynnfield, Massachusetts 01940

End of Directory

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TABLE OF CONTENTS

DIVISION 00 — PROCUREMENT AND CONTRACTING REQUIREMENTS

Document 00 01 01	Project Title Page
Document 00 01 02	Project Directory
Document 00 01 10	Table of Contents
Document 00 11 13	Invitation to Bid
Document 00 21 13	Instructions to Bidders
Document 00 21 14	eBidding Registration Instructions
Document 00 41 13	Form for General Bid
Document 00 41 14	Form for Filed Sub-Bid
Document 00 43 13	Bid Security Form (<i>AIA Form A310, 2010</i>)
Document 00 43 96	Company Information
Document 00 45 19	Non-Collusion Affidavit.
Document 00 45 20	Affidavit of Compliance.
Document 00 52 00	Owner-Contractor Agreement
Document 00 53 00	Form for Sub-Contract
Document 00 54 03	Vote of Corporation Authorizing Execution of Contract
Document 00 54 04	Statement of Tax Compliance
Document 00 54 05	Statement of OSHA Training Compliance
Document 00 54 22	Bid Attachment – Unit Prices Schedule
Document 00 61 13	Performance and Payment Bond Forms
Document 00 62 12	Product Submittal Form
Document 00 63 13	Request For Interpretation (RFI) Form
Document 00 63 25	Substitution Request Form
Document 00 72 00	General Conditions of the Contract for Construction
Document 00 73 37	Schedule for Participation by Minority/Women Business Enterprises (SDO Exhibit A)
Document 00 73 38	Letter of Intent - Minority/Women Business Enterprises Participation (SDO Exhibit B)
Document 00 73 39	Contractor Progress Payment Report, Minority/Women Business Enterprises Participation (SDO Exhibit C)
Document 00 73 43	Prevailing Wage Rates

DIVISION 01 — GENERAL REQUIREMENTS

Section 01 10 00	Summary
Section 01 22 00	Unit Prices
Section 01 23 00	Alternates
Section 01 25 13	Product Substitution Procedures
Section 01 31 00	Project Management and Coordination
Section 01 32 00	Construction Progress Documentation
Section 01 33 00	Submittal Procedures
Section 01 35 16	Alteration Project Procedures
Section 01 41 00	Regulatory Requirements
Section 01 41 17	Utilities Notification
Section 01 42 00	References
Section 01 45 00	Quality Control
Section 01 45 29	Testing Laboratory Services
Section 01 50 00	Temporary Facilities and Controls
Section 01 60 00	Product Requirements
Section 01 73 00	Execution
Section 01 73 29	Cutting and Patching

Section 01 75 00	Starting and Adjusting
Section 01 77 00	Closeout Procedures
Section 01 78 00	Closeout Submittals
Section 01 78 36	Warranties
Section 01 79 00	Demonstration and Training

DIVISION 02 — EXISTING CONDITIONS

Section 02 41 19	Selective Demolition
------------------	----------------------

DIVISION 03 — CONCRETE

Section 03 05 13	Concrete Sealers
Section 03 30 00	Cast-in-Place Concrete

DIVISION 04 — MASONRY

Section 04 00 01 *	Masonry Filed Sub-Bid Requirements (* Filed Sub-Bid Required)
Section 04 01 29 *	Restoration of Unit Masonry (* Filed Sub-Bid Required as part of Section 04 00 01)
Section 04 20 00 *	Reinforced Masonry (* Filed Sub-Bid Required as part of Section 04 00 01)
Section 04 22 00 *	Concrete Unit Masonry (* Filed Sub-Bid Required as part of Section 04 00 01)

DIVISION 05 — METALS

Section 05 50 00	Metal Fabrications
------------------	--------------------

DIVISION 06 — WOOD, PLASTICS AND COMPOSITES

Section 06 10 00	Rough Carpentry
Section 06 16 00	Sheathing
Section 06 16 73	Air Barrier Faced Sheathing
Section 06 20 00	Finish Carpentry
Section 06 40 00	Architectural Woodwork
Section 06 60 00	Plastic Fabrications
Section 06 61 16	Solid Surfacing Fabrications

DIVISION 07 — THERMAL AND MOISTURE PROTECTION

Section 07 00 02 *	Roofing and Flashing Filed Sub-Bid Requirements (* Filed Sub-Bid Required)
Section 07 11 13	Bituminous Dampproofing
Section 07 21 00	Thermal Insulation
Section 07 21 31	Closed Cell Sprayed Foam Insulation
Section 07 26 00	Vapor Retarders
Section 07 31 13 *	Asphalt Shingles (* Filed Sub-Bid Required as part of Section 07 00 02)
Section 07 46 46	Fiber Cement Siding
Section 07 62 00 *	Sheet Metal Flashing and Trim (* Filed Sub-Bid Required as part of Section 07 00 02)
Section 07 84 00	Firestopping
Section 07 92 00	Joint Sealants

DIVISION 08 — OPENINGS

Section 08 11 13	Hollow Metal Doors and Frames
Section 08 14 26	Molded Wood Doors

Section 08 14 33	Stile and Rail Wood Doors
Section 08 31 00	Access Doors and Panels
Section 08 31 23	Basement Bulkhead Access Doors
Section 08 35 14	Accordion Folding Doors
Section 08 54 00	Composite Windows
Section 08 56 19	Service Windows
Section 08 62 00 *	Unit Skylights (* Filed Sub-Bid Required as part of Section 07 00 02)
Section 08 71 00	Door Hardware (<i>not bound herewith, refer to notes on Drawings</i>)
Section 08 80 00	Glazing
Section 08 90 00	Louvers and Vents

DIVISION 09 — FINISHES

Section 09 00 09 *	Painting Filed Sub-Bid Requirements (* Filed Sub-Bid Required)
Section 09 01 66	Refinishing Wood Floors
Section 09 05 60	Common Work Results for Flooring
Section 09 29 00	Gypsum Board
Section 09 30 00	Tiling
Section 09 64 29	Wood Strip Flooring
Section 09 65 20	Resilient Plank Flooring
Section 09 65 23	Rubber Flooring
Section 09 68 00	Carpeting
Section 09 81 00	Acoustical Insulation
Section 09 91 00 *	Painting (* Filed Sub-Bid Required as part of Section 09 00 09)
Document 09 91 13 *	Exterior Painting Schedule (* Filed Sub-Bid Required as part of Section 09 00 09)
Document 09 91 23 *	Interior Painting Schedule (* Filed Sub-Bid Required as part of Section 09 00 09)

DIVISION 10 — SPECIALTIES

Section 10 28 13	Toilet Accessories
Section 10 40 00	Safety Specialties

DIVISION 11 — EQUIPMENT

Section 11 31 00	Residential Appliances
------------------	------------------------

DIVISION 14 — CONVEYING SYSTEMS

Section 14 22 00 *	Compact Traction Elevators (* Filed Sub-Bid Required)
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DIVISION 21 — FIRE SUPPRESSION

Section 21 00 01 *	Fire Suppression Filed Sub-Bid Requirements (* Filed Sub-Bid Required)
Section 21 05 17 *	Sleeves and Sleeve Seals for Fire Suppression Piping (* Filed Sub-Bid Required as part of Section 21 00 01)
Section 21 05 18 *	Escutcheons for Fire Suppression Piping (* Filed Sub-Bid Required as part of Section 21 00 01)
Section 21 05 48.13 *	Vibration and Seismic Controls for Fire Suppression Piping and Equipment (* Filed Sub-Bid Required as part of Section 21 00 01)
Section 21 05 53 *	Identification for Fire Suppression Piping and Equipment

Section 21 13 13 *	Wet Pipe Sprinkler Systems (* Filed Sub-Bid Required as part of Section 21 00 01)
DIVISION 22 — PLUMBING	
Section 22 00 01 *	Plumbing Filed Sub-Bid Requirements (* Filed Sub-Bid Required)
Section 22 05 13 *	Common Motor Requirements for Plumbing Equipment (* Filed Sub-Bid Required as part of Section 22 00 01)
Section 22 05 17 *	Sleeves and Sleeve Seals for Plumbing Piping (* Filed Sub-Bid Required as part of Section 22 00 01)
Section 22 05 18 *	Escutcheons for Plumbing Piping (* Filed Sub-Bid Required as part of Section 22 00 01)
Section 22 05 19 *	Meters and Gages for Plumbing Piping (* Filed Sub-Bid Required as part of Section 22 00 01)
Section 22 05 23 *	General Duty Valves for Plumbing Piping (* Filed Sub-Bid Required as part of Section 22 00 01)
Section 22 05 29 *	Hangers and Supports for Plumbing Piping and Equipment (* Filed Sub-Bid Required as part of Section 22 00 01)
Section 22 05 48 *	Vibration and Seismic Controls for Plumbing Piping and Equipment (* Filed Sub-Bid Required as part of Section 22 00 01)
Section 22 05 53 *	Identification for Plumbing Piping and Equipment (* Filed Sub-Bid Required as part of Section 22 00 01)
Section 22 07 19 *	Plumbing Piping Insulation (* Filed Sub-Bid Required as part of Section 22 00 01)
Section 22 11 16 *	Domestic Water Piping (* Filed Sub-Bid Required as part of Section 22 00 01)
Section 22 11 19 *	Domestic Water Piping Specialties (* Filed Sub-Bid Required as part of Section 22 00 01)
Section 22 11 22 *	Facility Natural Gas Piping (* Filed Sub-Bid Required as part of Section 22 00 01)
Section 22 11 23 *	Domestic Water Pumps (* Filed Sub-Bid Required as part of Section 22 00 01)
Section 22 13 16 *	Sanitary Waste and Vent Piping (* Filed Sub-Bid Required as part of Section 22 00 01)
Section 22 13 19 *	Sanitary Waste Piping Specialties (* Filed Sub-Bid Required as part of Section 22 00 01)
Section 22 36 00 *	Indirect Domestic Water Heater (* Filed Sub-Bid Required as part of Section 22 00 01)
Section 22 42 13.13 *	Commercial Water Closets (* Filed Sub-Bid Required as part of Section 22 00 01)
Section 22 42 16.13 *	Commercial Lavatories (* Filed Sub-Bid Required as part of Section 22 00 01)
Section 22 42 16.16 *	Commercial Sinks (* Filed Sub-Bid Required as part of Section 22 00 01)
DIVISION 23 — HEATING, VENTILATING AND AIR CONDITIONING	
Section 23 00 00 *	General Conditions for HVAC Work (* Filed Sub-Bid Required as part of Section 23 00 01)
Section 23 00 01 *	Heating, Ventilating and Air Conditioning Filed Sub-Bid Requirements (* Filed Sub-Bid Required)
Section 23 05 13 *	Common Motor Requirements for HVAC Equipment (* Filed Sub-Bid Required as part of Section 23 00 01)
Section 23 05 16 *	Expansion Fittings and Loops for HVAC Piping

Section 23 05 17 *	(* Filed Sub-Bid Required as part of Section 23 00 01) Sleeves and Sleeve Seals for HVAC Piping (* Filed Sub-Bid Required as part of Section 23 00 01)
Section 23 05 18 *	Escutcheons for HVAC Piping (* Filed Sub-Bid Required as part of Section 23 00 01)
Section 23 05 19 *	Meters and Gages for HVAC Piping (* Filed Sub-Bid Required as part of Section 23 00 01)
Section 23 05 23.12 *	Ball Valves for HVAC Piping (* Filed Sub-Bid Required as part of Section 23 00 01)
Section 23 05 23.14 *	Check Valves for HVAC Piping (* Filed Sub-Bid Required as part of Section 23 00 01)
Section 23 05 29 *	Hanger and Supports for HVAC Piping and Equipment (* Filed Sub-Bid Required as part of Section 23 00 01)
Section 23 05 48 *	Vibration and Seismic Controls for HVAC (* Filed Sub-Bid Required as part of Section 23 00 01)
Section 23 05 53 *	Identification for HVAC Piping and Equipment (* Filed Sub-Bid Required as part of Section 23 00 01)
Section 23 05 93 *	Testing, Adjusting and Balancing for HVAC (* Filed Sub-Bid Required as part of Section 23 00 01)
Section 23 07 16 *	HVAC Equipment Insulation (* Filed Sub-Bid Required as part of Section 23 00 01)
Section 23 07 19 *	HVAC Piping Insulation (* Filed Sub-Bid Required as part of Section 23 00 01)
Section 23 21 13 *	Hydronic Piping (* Filed Sub-Bid Required as part of Section 23 00 01)
Section 23 21 16 *	Hydronic Piping Specialties (* Filed Sub-Bid Required as part of Section 23 00 01)
Section 23 21 23 *	Hydronic Pumps (* Filed Sub-Bid Required as part of Section 23 00 01)
Section 23 23 00 *	Refrigerant Piping (* Filed Sub-Bid Required as part of Section 23 00 01)
Section 23 33 00 *	Air Duct Accessories (* Filed Sub-Bid Required as part of Section 23 00 01)
Section 23 35 33 *	Listed Kitchen Ventilation System Exhaust Ducts (* Filed Sub-Bid Required as part of Section 23 00 01)
Section 23 38 13 *	Commercial Kitchen Hoods (* Filed Sub-Bid Required as part of Section 23 00 01)
Section 23 52 16 *	Condensing Boilers (* Filed Sub-Bid Required as part of Section 23 00 01)
Section 23 62 00 *	Packaged Compressor and Condenser Units (* Filed Sub-Bid Required as part of Section 23 00 01)
Section 23 73 13.13 *	Indoor Basic Air Handling Units (* Filed Sub-Bid Required as part of Section 23 00 01)

DIVISION 26 — ELECTRICAL

Section 26 00 01 *	Electrical Filed Sub-Bid Requirements (* Filed Sub-Bid Required)
Section 26 05 00 *	General Conditions for Electrical Work (* Filed Sub-Bid Required as part of Section 26 00 01)
Section 26 05 19 *	Low-Voltage Electrical Power Conductors and Cables (* Filed Sub-Bid Required as part of Section 26 00 01)
Section 26 05 26 *	Grounding and Bonding for Electrical Systems (* Filed Sub-Bid Required as part of Section 26 00 01)
Section 26 05 33 *	Raceways and Boxes for Electrical Systems (* Filed Sub-Bid Required as part of Section 26 00 01)

Section 26 24 16 *	Panelboards (* Filed Sub-Bid Required as part of Section 26 00 01)
Section 26 27 26 *	Wiring Devices (* Filed Sub-Bid Required as part of Section 26 00 01)
Section 26 28 13 *	Fuses (* Filed Sub-Bid Required as part of Section 26 00 01)
Section 26 28 16 *	Enclosed Switches and Circuit Breakers (* Filed Sub-Bid Required as part of Section 26 00 01)
Section 26 51 19 *	LED Interior Lighting (* Filed Sub-Bid Required as part of Section 26 00 01)

DIVISION 28 — ELECTRONIC SAFETY AND SECURITY

Section 28 31 11 *	Digital, Addressable Fire-Alarm System (* Filed Sub-Bid Required as part of Section 26 00 01)
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DIVISION 31 — EARTHWORK

Section 31 00 00	Earthwork
Section 31 14 00	Earth Stripping and Stockpiling
Section 31 23 00	Excavation and Fill
Section 31 25 00	Erosion Control

DIVISION 32 — EXTERIOR IMPROVEMENTS

Section 32 12 00	Asphalt Paving
Section 32 16 13	Curbs
Section 32 17 23	Pavement Markings

DIVISION 33 — UTILITIES

Section 33 10 00	Water Distribution Piping
Section 33 31 00	Sanitary Utility Sewerage Piping
Section 33 41 00	Stormwater Drainage Systems
Section 33 49 00	Storm Utility Drainage Structures

End - Table of Contents

Document 00 11 13
INVITATION TO BID

- 1.1 The Town of Halifax, Massachusetts, invites sealed bids for the Pope's Tavern Addition/Renovation at 506 Plymouth Street, Halifax, Massachusetts in accordance with Contract Documents prepared by Winslow Architects, Inc., Arlington, Massachusetts.
 - 1.2 General Project Description: The general scope of work for this renovation and addition includes the following:
 - a. Site improvements.
 - b. Renovation of existing space, includes new accessible toilets on the First Floor, new renovated program spaces on the Second Floor.
 - c. Building addition includes a new multi-purpose community room, with associated kitchen and accessible elevator. The Second floor has space for future expansion.
 - d. New mechanical, electrical, plumbing and fire protection systems for the renovated and newly constructed spaces.
 - 1.3 Bidding procedures and award of Contract and Subcontracts are subject to the provisions of the General Laws of the Commonwealth of Massachusetts (MGL) including but not limited to c.149, §44A to §44J inclusive; applicable sections of MGL c.30.
 - 1.4 This Project is subject to the General Laws of the Commonwealth of Massachusetts (MGL) including but not limited to MGL c.7. General Bidders and Filed Sub-bidders are advised that before contract award, the lowest general bidder shall be required to provide the Owner with documentation stating how it intends to meet the minority and women business enterprise goals for the project. Those goals are:
 - MBE/WBE Combined 10.4% of construction contract amount
 - 1.5 Attention is called to the fact that not less than the prevailing wage rates as hereinafter set forth shall be paid on this Project. Attention is also called to the requirements relating to worker's compensation and conditions of employment. The minimum wages to be paid mechanics, apprentices, teamsters, chauffeurs, and laborers on the Project shall be established by the Minimum Wage Schedule, as determined by the Commissioner of Labor and Industries, pursuant to the provisions of MGL c.149, §25 to §27D, inclusive, as amended, which schedule is included in the Contract Documents.
- A. Certification for All Bidders:
- Under the provisions of MGL c.149, §44D½, the Awarding Authority will not pre-qualify applicants, nor publish a list of Contractors and Filed Subcontractors eligible to bid. General Contractors and Filed Subcontractors desiring to bid on the project should apply for certification by contacting the Commonwealth of Massachusetts:

Division of Capital Asset Management
Office of Contract Administration
One Ashburton Place, Boston, MA 02108
Telephone (617) 727-9320.

B. Certification for General Contract Bidders:

General Contract Bidders: Only certified General Contractors can bid on this project. Each General Contract Bidder must submit with its bid a copy of the *Certificate of Eligibility* (DCAMM Form CQ7) from the Division of Capital Asset Management and Maintenance (DCAMM) and a completed *Update Statement* (DCAMM Form CQ3), with its bid. Bidders failing to submit with their Bids, both the *Certificate of Eligibility* and *Update Statement*, will be rejected for failure to comply with statutory bidding requirements.

General Contract Bidder shall be certified by the Division of Capital Asset Management and Maintenance (DCAMM) for the following category of work and for a contract dollar amount which is not less than the estimated construction of this Project.

- Certification Category: "General Building Construction".
- Estimated Construction Cost: \$ **2,567,495**.

C. Certification for Filed Sub-bidders:

Filed Sub-bidders: Under the provisions of Massachusetts General Law, c.149, bidding will be open to all Filed Sub-bidders who are certified by the Division of Capital Asset Management (DCAM) for their trade.

Each Filed Sub-bidder must submit with its bid a copy of the Certificate of Eligibility from the Division of Capital Asset Management and Maintenance (DCAMM) and a completed *Subcontractor Update Statement*, with its bid. Filed Sub-bidders failing to submit with their Bids, both the *Certificate of Eligibility* and *Update Statement*, will be rejected for failure to comply with statutory bidding requirements.

D. Filed Sub-Bids will be required for the Work of the following Classes of Work (trades):

(DCAMM CERTIFIED) FILED BIDDERS

- | <u>Class of Work</u> | <u>Specification Sections and Titles</u> |
|-------------------------------|---|
| • <u>MASONRY</u> | as specified under Section 04 00 01 – Masonry Filed Sub-bid Requirements, and the following:
Section 04 01 29 – Restoration of Unit Masonry.
Section 04 20 00 – Reinforced Unit Masonry.
Section 04 22 00 – Concrete Unit Masonry. |
| • <u>ROOFING AND FLASHING</u> | as specified under Section 07 00 02 - Roofing and Flashing Filed Sub-bid Requirements, and the following:
Section 07 31 13 - Asphalt Shingles.
Section 07 62 00 - Sheet Metal Flashing and Trim.
Section 08 62 00 - Unit Skylights |

- PAINTING as specified under Section 09 00 09 - Painting Filed Sub-bid Requirements, and the following:
 - Section 09 91 00 – Paints.
 - Document 09 91 13 - Exterior Paint Schedule.
 - Document 09 91 23 - Interior Paint Schedule
- ELEVATORS as specified under Section 14 22 00 – Compact Traction Elevators.
- FIRE PROTECTION as specified under Section 21 00 01 - Fire Suppression, and the following:
 - Section 21 05 17 - Sleeves and Sleeve Seals for Fire Suppression Piping
 - Section 21 05 18 - Escutcheons for Fire Suppression Piping
 - Section 21 05 48.13 - Vibration and Seismic Controls for Fire Suppression Piping and Equipment
 - Section 21 05 53 - Identification for Fire Suppression Piping and Equipment
 - Section 21 13 13 - Wet Pipe Sprinkler Systems
- PLUMBING as specified under Section 22 00 01 – Plumbing, and the following:
 - Section 22 05 13 - Common Motor Requirements for Plumbing Equipment
 - Section 22 05 17 - Sleeves and Sleeve Seals for Plumbing Piping
 - Section 22 05 18 - Escutcheons for Plumbing Piping
 - Section 22 05 19 - Meters and Gages for Plumbing Piping
 - Section 22 05 23 - General Duty Valves for Plumbing Piping
 - Section 22 05 29 - Hangers and Supports for Plumbing Piping and Equipment
 - Section 22 05 48 - Vibration and Seismic Controls for Plumbing Piping and Equipment
 - Section 22 05 53 - Identification for Plumbing Piping and Equipment
 - Section 22 07 19 - Plumbing Piping Insulation
 - Section 22 11 16 - Domestic Water Piping
 - Section 22 11 19 - Domestic Water Piping Specialties
 - Section 22 11 22 - Facility Natural Gas Piping
 - Section 22 11 23 - Domestic Water Pumps
 - Section 22 13 16 - Sanitary Waste and Vent Piping
 - Section 22 13 19 - Sanitary Waste Piping Specialties
 - Section 22 36 00 - Indirect Domestic Water Heater
 - Section 22 42 13.13 - Commercial Water Closets
 - Section 22 42 16.13 - Commercial Lavatories
 - Section 22 42 16.16 - Commercial Sinks

- HEATING, VENTILATION AND AIR CONDITIONING as specified under Section 23 00 01 - Heating, Ventilation and Air Conditioning, and the following:
 - Section 23 00 00 - General Conditions for HVAC Work
 - Section 23 05 13 - Common Motor Requirements for HVAC Equipment
 - Section 23 05 16 - Expansion Fittings and Loops for HVAC Piping
 - Section 23 05 17 - Sleeves and Sleeve Seals for HVAC Piping
 - Section 23 05 18 - Escutcheons for HVAC Piping
 - Section 23 05 19 - Meters and Gages for HVAC Piping
 - Section 23 05 23.12 - Ball Valves for HVAC Piping
 - Section 23 05 23.14 - Check Valves for HVAC Piping
 - Section 23 05 29 - Hanger and Supports for HVAC Piping and Equipment
 - Section 23 05 48 - Vibration and Seismic Controls for HVAC
 - Section 23 05 53 - Identification for HVAC Piping and Equipment
 - Section 23 05 93 - Testing, Adjusting and Balancing for HVAC
 - Section 23 07 16 - HVAC Equipment Insulation
 - Section 23 07 19 - HVAC Piping Insulation
 - Section 23 21 13 - Hydronic Piping
 - Section 23 21 16 - Hydronic Piping Specialties
 - Section 23 21 23 - Hydronic Pumps
 - Section 23 23 00 - Refrigerant Piping
 - Section 23 33 00 - Air Duct Accessories
 - Section 23 35 33 - Listed Kitchen Ventilation System Exhaust Ducts
 - Section 23 38 13 - Commercial Kitchen Hoods
 - Section 23 52 16 - Condensing Boilers
 - Section 23 62 00 - Packaged Compressor and Condenser Units
 - Section 23 73 13.13 - Indoor Basic Air Handling Units
- Electrical as specified under Section 26 00 01 – Electrical. and the following:
 - Section 26 05 00 - General Conditions for Electrical Work
 - Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables
 - Section 26 05 26 - Grounding and Bonding for Electrical Systems
 - Section 26 05 33 - Raceways and Boxes for Electrical Systems
 - Section 26 24 16 - Panelboards
 - Section 26 27 26 - Wiring Devices
 - Section 26 28 13 - Fuses
 - Section 26 28 16 - Enclosed Switches and Circuit Breakers
 - Section 26 51 19 - LED Interior Lighting
 - Section 28 31 11 - Digital, Addressable Fire-Alarm System

E. Availability of Bidding documents:

Copies of the Bidding Documents, may be obtained after 9:00 AM local time, Wednesday, July 11, 2018. Bid Forms and Contract Documents will be available for pick-up at www.biddocsonline.com (may be viewed electronically and hardcopy requested) or at Nashoba Blue, Inc. at 433 Main Street, Hudson, MA 01749 (978-568-1167).

There is a plan deposit of \$100.00 per set (maximum of 2 sets) payable to BidDocs ONLINE Inc.

Additional sets may be purchased for \$100.00 (non-refundable)

Bidders requesting Contract Documents to be mailed to them shall include a separate check for \$ 40.00 per set for UPS Ground (or \$65.00 per set for UPS overnight), non-refundable, payable to the BidDocs ONLINE Inc., to cover mail handling costs.

All bids shall be accompanied with a bid security in the amount of five percent (5%) of the greatest possible bid amount. (Refer to Paragraph H below).

The Bidding Documents may be seen, but not removed from the following locations, during regular office hours:

Winslow Architects, Inc.
89 Massachusetts Avenue
Arlington, Massachusetts 02474

F. Pre-Bid Conference:

Site Visits will be held on Wednesday, July 25, 2018 at 11 AM. local time at the Pope's Tavern Senior Center, 506 Plymouth Street, Halifax, Massachusetts. All bidders are strongly encouraged to attend.

G. Receipt of Bids:

THIS PROJECT IS BEING ELECTRONICALLY BID AND HARD COPY BIDS WILL NOT BE ACCEPTED. Please review the instructions in the bid documents on how to register as an electronic bidder. The bids are to be prepared and submitted at WWW.BIDDOCSONLINE.COM . Tutorials and instructions on how to complete the electronic Bid documents are available online (click on the "tutorial" tab at the bottom footer).

ELECTRONIC BIDS FOR FILED SUB-BIDS listed above will be received by the Awarding Authority until 2 PM. local time[Ⓢ], Wednesday, August 1, 2018, and publicly opened online forthwith.

ELECTRONIC BIDS FOR THE GENERAL CONTRACT listed above will be received until 2 PM. local time[Ⓢ], Wednesday August 8, 2018 and publicly opened online forthwith.

[Ⓢ]Official time is that electronically established by BidDocs ONLINE for the Awarding Authority; no late bids will be accepted.

July 11, 2018

H. Bid Security:

Bid Security: All General Bid and Filed Sub-bid proposals shall be accompanied by a bid deposit in an amount not less than five percent (5%) of the value of the bid. Bid deposits, payable to the "Town of Halifax" shall be in the form of either a BID BOND, or a CERTIFIED or TREASURER'S CHECK issued by a responsible bank or trust company. Cash and company checks are not acceptable.

I. Sales Tax:

Sales Tax: Materials, equipment and supplies to be used on this project are exempt from sales tax to the extent provided by MGL c.64(H), §6(f). Bidders should not include taxes in figuring or in references to any bid.

J. Wages:

Wages: The minimum wages to be paid mechanics, apprentices, teamsters, chauffeurs, and laborers on the Project shall be established by the Minimum Wage Schedule, as determined by the Commissioner of Labor and Industries, pursuant to the provisions of MGL c.149, §25 to §27D, inclusive, as amended, which schedule is included in the Bidding Documents.

K. Performance, Labor and Materials Bonds:

A one hundred percent (100%) Performance Bond and a one hundred percent (100%) Labor and Materials Payment Bond will be required from the successful General Contract Bidder.

Each successful Filed Sub-bidder will be required to provide a Performance Bond, and a Labor and Materials Payment Bond to the General Contractor if requested to do so as required under MGL c.149 §44 F(2)D.

L. Contract Award:

Upon receipt of bids, the Awarding Authority must determine, from information submitted on the Update Statement, whether the apparent low bidder is responsible and can be awarded the Contract.

The Awarding Authority will reject general bids and filed sub-bids when required to do so by the above-referenced General Laws. In addition, the Awarding Authority reserves the right to waive any informalities in bidding and to reject any and all general bids if it deems it in the public interest to do so. Also, the Awarding Authority reserves the right to reject any sub-bid if it determines that such sub-bid does not represent the bid of a person competent to perform work as specified or that less than three such sub-bids were received and that the prices are not reasonable for acceptance without further competition.

All bids shall remain in effect for 30 days (Saturdays, Sundays, and legal holidays excluded) after opening of General Bids. Successful bidders shall agree to commence work and complete the Work in accordance with the dates set forth in the Bidding Documents.

July 11, 2018

POPE'S TAVERN
ADDITION/RENOVATION
Halifax, Massachusetts

Work shall begin within seven (7) calendar days from receipt by Contractor of Notice to Proceed. Work shall be substantially completed in 270 calendar days from receipt by Contractor of Notice to Proceed.

Charles Seelig
Town Administrator
Town of Halifax

End of Document

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Document 00 21 13
INSTRUCTIONS TO BIDDERS

ARTICLE 1 – STATUTE REFERENCES

- A. Wherever in the Contract Documents reference is made to General Laws of Massachusetts, (MGL), it shall be construed to include all amendments thereto effective as of the date of issue of INVITATION TO BID on the proposed work.
- B. General Bid and Filed Sub-Bids are subject to the provisions of Massachusetts General Laws, including but not limited to Chapter 149 and Chapter 30, and all other applicable provisions of MGL.
 - 1. This "Instructions to Bidders" contains important information about bidding procedures and is intended to provide guidance and assistance to bidders. This "Instructions to Bidders" does not change or supersede the provisions of the above referenced Massachusetts General Laws, or other provisions of Statute Law.
 - 2. In the event of any conflict or inconsistency between the provisions of the Bid and Contract Documents and the provisions of applicable law, the provisions of law shall govern. In such event, the application of all remaining provisions of the Bid and Contract Documents not in conflict and not inconsistent with applicable law shall not be affected thereby.
- C. The attention of bidders is called to MGL Chapter 149, Section 179A, which requires persons contracting to do public work to give preference in awarding contracts to persons who are citizens of the United States and to partnerships all of whose members are such citizens.
 - 1. Foreign Corporations: Attention of all Bidders is directed to provisions of MGL Chapter 30, Section 39L, as amended, which provides that the Awarding Authority may not enter into a contract for construction work, and may not approve as a subcontractor furnishing labor and materials for a part of any such work, a foreign corporation that has not complied with certain requirements of Chapter 156D of the Massachusetts General Laws. The term "foreign corporation" means a corporation not incorporated under the laws of the Commonwealth of Massachusetts. Bidders are responsible to know and comply with the requirements of Section 39L of Chapter 30.

ARTICLE 2 – DEFINITIONS

- A. Awarding Authority: Town of Halifax, Massachusetts
Town of Halifax
499 Plymouth Street
Halifax, Massachusetts 02338
- B. Architect (Designer):
Winslow Architects, Inc.
89 Massachusetts Avenue
Arlington, Massachusetts 02474
- C. Bidding Documents: As referenced herein refers to Document 00 11 13 - INVITATION TO BID, Document 00 21 13 - INSTRUCTIONS TO BIDDERS, Document 00 41 13 - FORM FOR GENERAL BID, Document 00 41 13 - FORM FOR FILED SUB-BID, all other

bid requirements, and the "Contract Documents" (see Form of Agreement for definition of "Contract Documents"), including all Addenda.

1. Document 00 11 13 – INVITATION TO BID and this Document 00 21 13 – INSTRUCTIONS TO BIDDERS contain important information about bidding procedures and are intended to provide guidance and assistance to bidders. Both documents are complementary and should be carefully reviewed by Bidders for specific instructions. Information contained in Document 00 11 13 is not repeated herein this Document 00 21 13.
 - a. Document 00 11 13 – INVITATION TO BID and this Document 00 21 13 – INSTRUCTIONS TO BIDDERS do not change or supersede the provisions of Massachusetts General Laws, including the provisions of Chapter 149 and Chapter 30, and all other applicable provisions of law, as amended.

ARTICLE 3 - BIDDER QUALIFICATIONS

- A. General bids must be accompanied by a Certificate of Eligibility issued by the Division of Capital Asset Management and Maintenance (DCAMM) showing that the Bidder has been approved to bid on projects of the size and type of the named project, and by a Contractor Update Statement (Form CQ3).
- B. It is the bidder's responsibility to obtain the necessary forms from the Division of Capital Asset Management and Maintenance (DCAMM) and make application in sufficient time for the Division of Capital Asset Management and Maintenance to evaluate the application and issue a Certificate of Eligibility.
- C. The Contractor Update Statement is not a public record as defined in MGL Chapter 4, Section 7 and will not be open to public inspection.
- D. Each General Bidder and Filed Sub-Bidder shall be certified by the Massachusetts Division of Capital Asset Management and Maintenance (DCAMM) for the category of work and the dollar amount of this project in accordance with the provisions of Massachusetts General Laws Chapter 149 before consideration for such bid will be given.
 1. DCAMM Classification Rating Required for General Bidders on this Contract: General Contracting.
- E. In compliance with MGL Chapter 149, Section 44D, as amended, ALL BIDS (every General Bid and Filed-Sub-bid) shall be accompanied by a copy of a DCAMM Certificate of Eligibility and Contractor's Update Statement.
 1. Forms are Required from General Bidders: The Awarding Authority will use the Certificate of Eligibility and Update Form, among other information, to determine the lowest responsible and eligible bidder. General Bids submitted without Certificate of Eligibility and Update Statement shall be invalid. Filed Sub-bidders are also required to submit Certificates of Eligibility and an Update Statement.
 2. Public Records: Contractor's Update Statement is not a public record as defined in MGL Chapter 4, Section 7, and will not be open to public inspection.

ARTICLE 4 - EXAMINATION OF DOCUMENTS AND SITE CONDITIONS

- A. Site Visit: Each bidder is strongly encouraged to visit the site of proposed work and become fully and completely aware of all existing conditions and the character of the operations to be carried on under the proposed Contract. Each bidder shall become fully familiar with the facilities, physical conditions, and restrictions attending the work under the Contract. Failure to make such examinations will not relieve the bidder from any obligation under the General Bidder's proposal, or Filed-Sub-Bid, as submitted, and bidders agree, by virtue of submitting a bid, that they will make no claim on account of their failure to discover that which may have been discovered upon such examinations and visit.
- B. Document Examination: Each Bidder shall thoroughly examine and become familiar with the Contract Documents and the Bidding Requirements. Failure of any General Bidder or Filed Sub-bidder to thoroughly examine the Bidding Requirements and Contract Documents, shall in no way relieve him of any obligation with respect to his bid or of any responsibility assigned him under the Contract, and bidders agree, by virtue of submitting a bid, that they will make no claim on account of their failure to discover that which may have been discovered upon such an examinations.
- C. Pre-Bid Conference at Site: An open, public pre-bid conference will be convened at the site to permit bidders to examine the site, examine existing conditions, and ask questions. Time and place of the Pre-Bid Conference is indicated in Document 00 11 13 – INVITATION TO BID. All general bidders and Filed Sub-bidders are strongly encouraged to attend.

ARTICLE 5 - ADDENDA AND INTERPRETATION

- A. Bidders shall promptly notify the Architect of questions, ambiguities, and inconsistencies which they may discover upon examination of the Contract Documents, the site, and local conditions. All questions by prospective bidders as to the interpretation of the Contract Documents shall be submitted in writing to the Architect's office.
 - 1. Written requests: Submit written requests for clarification and interpretation to the Architect only by mail or fax.
 - a. Telephone calls pointing out errors or discrepancies in the documents will be received by the Architect, but only for receipt of information and potential processing, but not for interpretation or clarification.
 - b. Oral or telephone interpretations will not be made.
 - 2. Timing of requests: Requests for clarification and interpretations must be received by the Architect at least 5 working days (Saturdays, Sundays, Federal and Massachusetts State Holidays excluded) prior to the date bids are due.
- B. Architect's Response: If the Architect considers such request for clarification or interpretation to be of sufficient importance, the Architect will issue a response in the form of a written Addenda which will become part of the Contract Documents. Clarifications and interpretations offered by the Authority, the Architect, or any of the Architect's consultant's in any form other than a formal written Addenda shall be invalid.

July 11, 2018

- C. Issuance of Addenda: All modifications to the bid documents will be issued via an addendum. All registered plan holders will be electronically notified when addenda are issued. Hard copies of the addenda will not be forwarded to the plan holders. The bidder is solely responsible for reviewing all addenda posted on the project website. The bidder must acknowledge all addenda have been reviewed by selecting "yes" or "no" as part of the eBidding process. If the bidder selects "no", the bidder will automatically be directed to the Addenda icon on the project page.

Failure to receive and review Addenda shall in no way relieve any Bidder from the execution of its provisions. All Bidders shall verify the number of Addenda which have been issued and obtain Addenda from BidDocs Online before submitting a bid.

- D. Acknowledgement of Addenda on Bid Form: Bidders shall acknowledge Addenda in the spaces provided on bid forms. Failure of a bidder to acknowledge Addenda in the spaces provided on bid form will cause rejection of the bid. Failure of the bidder to receive any addenda shall not relieve it from any obligation under its bid as submitted.

ARTICLE 6 - PREPARATION AND SUBMISSION OF BIDS

- A. General bids shall be for the complete work as specified and shall include the names of Filed Sub-bidders and the amounts of their sub-bids. The General Contractor shall be selected on the basis of such general bids. Sub-bids for each trade designated on the FORM FOR GENERAL BID shall be for the complete work of the trade as specified and filed with the Awarding Authority as provided in the INVITATION TO BID.
- B. General Bids and Filed Sub-Bids will be received by BidDocs Online, Inc. on behalf of the Awarding Authority as specified in the Document 00 11 16 - INVITATION TO BID. Please review the instructions in the bid documents on how to register as an electronic bidder. The bids are to be prepared and submitted at www.biddocsonline.com. Tutorials and instructions on how to complete the electronic bid documents are available online (click on the "Tutorial" tab at the bottom footer).
- C. Electronic Bids will be received through the BidDocs Online, Inc. website. The Boylston Public Library project is being electronically bid and hard copy bids will not be accepted. Please review the instructions in the bid documents on how to register as an electronic bidder. The bids are to be prepared and submitted at www.biddocsonline.com. Tutorials and instructions on how to complete the electronic bid documents are available online.
1. Filed Sub-Bids: Each Filed Sub-Bid shall be submitted electronically in accordance with BidDocs ONLINE, Inc.'s eBidding Instructions to Bidders included with this document. All blank spaces shall be filled in words and figures, and in figures only where no space is provided for words, and signed by the Filed Sub-Bidder using Document 00 41 14 - FORM FOR FILED SUB-BID and including the Bid Security,
FILED SUB-BID: _____ Pope's Tavern Addition/Renovation
Halifax, Massachusetts
 2. General Bids: Each General Bid shall be submitted electronically in accordance with BidDocs ONLINE, Inc.'s eBidding Instructions to Bidders included with this document. All blank spaces shall be filled in words and

figures, and in figures only where no space is provided for words, and signed by the General Bidder using Document 00 41 13 - FORM FOR GENERAL BID and including the Bid Security,

GENERAL BID: _____ Pope's Tavern Addition/Renovation
Halifax, Massachusetts

- D. Unit Prices –General Contract Bids and Filed Sub-Bids are required to include Document 00 54 22 – UNIT PRICES SCHEDULE attached to respective bid forms.
 - 1. Failure to include Document 00 54 22 will result in rejection of Bidder's proposal as being considered incomplete.
- E. No bid may be withdrawn for a period of ninety (90) days, Saturdays, Sundays and legal holidays excluded, after opening of Bids. No telephone or telegraphic bid, change in bid or withdrawal of bid will be received or recognized.
- F. Electronic withdrawal or modification of any bid is permitted up to the date and time bids are due by accessing the BidDocs Online, Inc. website. No modified bids will be accepted after the date and time indicated for receipt of bids.
- G. Refer to Document 00 11 16 - INVITATION TO BID and Bid Forms for additional instructions and requirements.

ARTICLE 7 - BID DEPOSIT REQUIREMENTS AND PROCEDURES

- A. The following matters respecting bid deposits are governed by MGL Section 44B of Chapter 149. Every general bid and every sub-bid not accompanied by the prescribed bid deposit will be rejected.
- B. Each general bid and each sub-bid for designated trades must be accompanied by a deposit in the form of a bid bond, or cash or a certified check on, or a treasurer's or cashier's check issue by, a responsible bank or trust company, payable to the "Town of Halifax". A bid bond shall be (a) with a surety company qualified to do business in the Commonwealth of Massachusetts and satisfactory to the Awarding Authority, and (b) conditioned upon the faithful performance by the principal of the agreements contained in the bid. The amount of such bid deposit shall be five percent (5%) of the amount of the bid.
 - 1. Filed Sub-Bids are required for trades listed in Document 00 11 13 - INVITATION TO BID.
- C. All bid deposits of general bidders, except those of the three (3) lowest responsible and eligible general bidders, shall be returned within ten (10) days, Saturdays, Sundays and legal holidays excluded after the opening of the general bids. The bid deposits of the three (3) lowest responsible and eligible general bidders shall be returned upon the execution and delivery of the contract, or, if no award made, upon the expiration of thirty (30) calendar days after the date of opening General Bids; except that, any selected general bidder fails to perform its agreement to execute contract and furnish a performance bond and also a labor and materials or payment bond as stated in its bid in accordance with MGL Section 44E of Chapter 149, its deposit shall become and be the property of the Awarding Authority as liquidated damages, provided that the amount of the bid deposit which becomes the property of the Awarding Authority shall not, in any event, exceed the difference between its bid price and the bid price of the next lowest responsible and eligible

bidder; and provided further that, in case of death, disability, bona fide clerical or mechanical error of a substantial nature, or other similar unforeseen circumstances affecting the general bidder, its bid deposit shall be returned to him/her named in the general bids.

- D. All bid deposits of sub-bidders, except those of the three (3) lowest responsible and eligible sub-bidders, shall be returned within ten (10) days, Saturdays, Sundays and legal holidays excluded after the opening of the general bids. The bid deposits of the three (3) lowest responsible and eligible filed sub-bidders shall be returned upon the execution of the General Contract, except that, if a selected sub-bidder fails to perform its agreement to execute a subcontract with the general bidder selected as the General Contractor, contingent upon the execution of the general contract, and, if requested to do so in the general bid by such general bidder, to furnish a performance and payment bond as stated in his sub-bid in accordance with MGL Section 44F(2) of Chapter 149, the bid deposit of such sub-bidder shall become and be the property of the Awarding Authority as liquidated damages, provided that the amount of the bid deposit which becomes the property of the Awarding Authority shall not, in any event, exceed the difference between its sub-bid price and the sub-bid price of the next lowest responsible and eligible sub-bidder; and provided further that, in case of death, disability, bona fide clerical or mechanical error of a substantial nature, or other similar unforeseen circumstances affecting the general bidder, its bid deposit shall be returned to him/her named in the general bids.
- E. In addition to the provisions for the return of bid deposits in the foregoing Paragraphs upon receipt of a bid bond in an amount not less than the amount of the required bid deposit, the Awarding Authority shall return any bid deposit of a bidder forthwith after public opening of bids. The bid bond shall be in an amount and in the form provided.

ARTICLE 8 – BID SUBMISSION CHECKLIST

- A. General Bids: On or before the date and time of receipt of General Bids, General Bidders must submit the following:
1. Document 00 41 13 - Form for General Bid.
 2. Document 00 43 13 - Bid Security Form (AIA Form A310 -Bid Bond).
or another acceptable form of Bid Security
 3. Document 00 43 96 - Company Information.
 4. Document 00 45 19 - Non-Collusion Affidavit.
 5. Document 00 45 20 - Affidavit of Compliance.
 6. DCAMM Certificate of Eligibility (*not bound herewith*).
 7. DCAMM form – Contractor's Update Statement (*not bound herewith*).
 8. Document 00 54 22 - Unit Prices Schedule (Bid Form Attachment).
- B. Filed Sub-Bids: On or before the date and time of receipt of Filed Sub-Bids, Filed Sub-Bidders must submit the following:
1. Document 00 41 14 - Form for Filed Sub-Bid.
 2. Document 00 43 13 - Bid Security Form (AIA Form A310 -Bid Bond).
or another acceptable form of Bid Security

3. Document 00 43 96 - Company Information.
4. Document 00 45 19 - Non-Collusion Affidavit.
5. Document 00 45 20 - Affidavit of Compliance.
6. DCAMM Certificate of Eligibility (*not bound herewith*).
7. DCAMM form – Contractor's Update Statement (*not bound herewith*).
8. Document 00 54 22 - Unit Prices Schedule (Bid Form Attachment).

ARTICLE 9 – FORM OF CONTRACT

- A. Form of Agreement between Awarding Authority and General Contractor: An example Form of Contract for Construction Services is included in the Bidding Documents.
- B. Form of Agreement between General Contractor and Filed Subcontractor: An example Form of Contract for Construction Services is included in the Bidding Documents.

ARTICLE 10 - ALTERNATES

- A. Bid on all alternates listed in the Contract Documents. In the event an alternate does not involve a change in the amount of the base bid, indicate this by writing "No Change" in the space provided for the price of that alternate.
- B. Filed Sub-bidders shall enter on the Form for Sub-Bid the dollar amount of addition or subtraction, or the indication of "No Change" which pertains to the Work of the particular trade as defined in the Specifications.
- C. General Bidders shall enter on the Form for General Bid a single amount of addition or subtraction to the base bid, or the indication of "No change" for each alternate. The said amount for each alternate shall include the sum of all Sub-bidders Work and the Work of the General Contractor.

ARTICLE 11 - SALES TAX EXEMPTION

- A. The Town of Halifax is exempt from certain taxes as provided by MGL Chapter 64H, Section 6(f). It is therefore required that the Contractor and all Subcontractors purchasing taxable goods or services make known to suppliers the tax-exempt status of the Owner, in order that such taxes will not be applied to the goods under Contract. The Town of Halifax will provide the necessary evidence and certificates of its tax-exempt status to the General Contractor and Filed Subcontractors at the Pre-construction Conference.
- B. Copies and Receipts Required: In compliance with Department of Revenue regulations, the Contractor shall provide the Awarding Authority with copies of all receipts for materials and products used for this Contract purchased using the Awarding Authority's Tax Exemption Number.

ARTICLE 12 – LOCAL FEES

- A. Fees: The building permit fee for the project has been waived by the Town of Halifax. All electrical and plumbing permits are required. All other permits required by Town, State Agencies or other public agencies will require payment of fees.

Each Bidder shall take this into account in calculating his or her bid for work. The General Contractor shall receive the building, electrical and plumbing permits prior to performing any work on the Project.

- B. The General Bidder and Sub-Bidders are responsible for all other permits, fees, inspections, and licenses, as may be required by State and local authorities.

ARTICLE 13 – EQUAL EMPLOYMENT OPPORTUNITY REQUIREMENTS

- A. MBE and WBE: General bidders and filed sub-bidders are advised that before contract award, the lowest general bidder shall be required to provide the Owner with documentation stating how it intends to meet the minority and women business enterprise goals for the project. Those goals are:
- MBE/WBE Combined 10.4% of construction contract amount
1. Filed sub-bidders and general bidders are strongly encouraged to include with their bid submissions documentation such as Letters of Intent executed by certified MBEs and WBEs, indicating the names, dollar values, and category of work that the general bidder or the sub-bidder intends to subcontract to certified MBEs and WBEs.
- B. The Owner reserves the right to reduce or waive the MBE or WBE participation goals established for this Contract. Bidders shall undertake all commercially reasonable steps to attain the M/WBE participation goals established by the Owner for this Contract. The Bidder shall provide, upon request of the Owner, evidence of the actions undertaken by the Bidder that may include but may not be limited to:
1. A list of all items of work under the Contract that the Bidder made available for subcontracting to M/WBEs. The Bidder shall identify all items of work, other than work to be performed by filed sub-bidders, that the Bidder did not make so available and shall state the reasons for not making such work available for subcontracting to M/WBEs. The Bidder shall also demonstrate that, where commercially reasonable, subcontracts were divided into units capable of being performed by M/WBEs.
 2. Evidence that the Bidder sent written notices soliciting Bids or proposals to perform the items of work made available by the Bidder for subcontracting to M/WBEs to all M/WBEs qualified to perform such work. The Bidder shall identify (i) each M/WBE solicited, and (ii) each M/WBE listed in the SDO directory under the applicable trade category that was not solicited and reasons therefor. The Bidder shall also state the dates that notices were mailed and provide a copy of the written notice(s) sent.
 3. Evidence that the Bidder made reasonable efforts to follow up the written notices sent to M/WBEs with telephone calls or personal visits in order to determine with certainty whether the M/WBEs were interested in performing the work. Phone logs or other documentation must be submitted.
 4. A statement of the response received from each M/WBE solicited, including the reason for rejecting any M/WBE who submitted a bid or proposal.
 5. Evidence of efforts made to assist M/WBEs that needed assistance in obtaining bonding or insurance, or lines of credit with suppliers if the inability of M/WBEs to obtain bonding, insurance, or lines of credit is the reason given for the Bidder's inability to meet the M/WBE goals.
 6. The Bidder may also submit any other information supporting its efforts to attain the M/WBE participation goals, including without limitation evidence that

the Bidder placed advertisements in appropriate media and trade association publications announcing the Bidder's interest in obtaining bids or proposals from M/WBEs, and/or sent written notification to M/WBE economic development assistance agencies, trade groups and other organizations notifying them of the Contract and the work to be subcontracted by the Bidder to M/WBEs.

- C. Within a reasonable time after the opening of general Bids, the apparent low Bidder shall submit the following documents to the Owner: (i) a completed Schedule for Participation by Minority/Women Business Enterprises in a form acceptable to the Owner showing M/WBE participation in amounts equal to or exceeding the M/WBE participation goals for this Contract, (ii) a completed Letter of Intent in a form acceptable to the Owner for each M/WBE listed in the Schedule for Participation, and (iii) a current SDO certification letter for each M/WBE listed in the Schedule of M/WBE Participation showing that the M/WBE is certified in the area of work for which it is listed on the Letter of Intent.
- D. Each Letter of Intent shall identify and describe the work to be performed by the named M/WBE (the "M/WBE Work") with enough specificity to permit the Owner to identify the particular items of contract work that the M/WBE will perform for M/WBE participation credit. The Owner reserves the right to reject any Letter of Intent if the price to be paid for the M/WBE Work does not bear a reasonable relationship to the value of such work under the Contract as determined by the Owner.
- E. Within five (5) working days after receipt of the Schedule For M/WBE Participation, Letters of Intent, and SDO certification letters, the Owner shall review and either approve or disapprove the apparent low Bidder's submissions.

ARTICLE 14 – WITHDRAWAL OF BIDS

- A. Any bid may be withdrawn (retracted) prior to the time designated for receipt of bids upon clicking the tab "Retract Bid". Both the bidder and Awarding Authority will receive an email confirming the bidder retracted the bid.
- B. Withdrawn bids may be modified and resubmitted up to the time designated for the receipt of bids.

ARTICLE 14 - REJECTION OF BIDS

- A. The Awarding Authority reserves the right to reject any or all General Bids, to revise the contract Documents and rebid, if it be in the public interest to do so. The Awarding Authority reserves the right to reject any sub-bid on any trade, if it determines that such sub-bid does not represent the sub-bid of a person competent to perform the work as specified, or if less than three (3) such sub-bids were received for each filed sub-bid trade category, or the bid prices are not acceptable without further competition.
- B. Sub-bids which are restricted to use by one General Contractor and are deemed to be unrealistic in that the proposed price is substantially less or more than the actual cost to complete all the work specified in that Section of the Specifications will be considered as not responsive to the Invitation to Bid and shall be rejected (Massachusetts Department of Labor and Industries Ruling N^o.136 and N^o.169.)

July 11, 2018

- C. Within five (5) days, Saturdays, Sundays and legal holidays excluded, after opening of sub-bids, the Awarding Authority will reject every sub-bid which is not accompanied by the required bid deposit or which otherwise does not conform to the statutory requirements, or which is on a form not completely filled in, or which is incomplete, conditional or obscure, or which contains any addition not called for, provided, however, that the failure of the Awarding Authority to reject such a sub-bid within such period shall not validate such a sub-bid nor preclude the Awarding Authority from subsequently rejecting it.
- D. Every general bid which is not accompanied by the required bid deposit, or which otherwise does not conform to the statutory requirements, or which is on a form not completely filled in, or which is incomplete, conditional or obscure, or which contains any addition not called for, shall be invalid; and the Awarding Authority shall reject every such bid.
- E. No general bid or sub-bid shall be rejected because of the failure to submit prices for, or information relating to, any item or items for which no specific space is provided in the bid form furnished by the Awarding Authority, but this sentence shall not be applicable to any failure to furnish prices or information required by MGL Chapter 149 Section 44E (in the case of general bids) or MGL Section 44F (in the case of sub-bids) of Chapter 149. No general bid shall be rejected (1) because the sum of the prices for all work of the General Contractor and sub-bids does not equal the general bid price set forth on the bid form for that purpose or (2) because of error in setting forth the name, the sub-bid price of a sub-bidder, or the total sub-bids as long as the sub-bidder or sub-bidders designated are clearly identifiable, or (3) because the plans and specifications do not accompany the bid or are not submitted with the bid.
- F. Any unit price bid that contains a unit price which is unduly high or low may be rejected as unbalanced. In the event of a discrepancy between the Arabic numerals and the written words, if the intent of the bidder is not clear as finally determined by the Awarding Authority, the written word shall prevail.

ARTICLE 15 - METHOD OF AWARD

- A. Bid Opening: Bids will be opened in public at the time and date specified in Document 00 11 13, and bidders may be present at the bid opening. Bid amounts will be read aloud, recorded, and referred to the Awarding authority for consideration.
- B. Contract Award: Subject to Chapter 149 of the General Laws, the Contract will be awarded within 30 days after receipt of general bids (Saturdays, Sundays, and Legal Holidays excluded) to the lowest responsible and eligible bidder, on the basis of the proposed base contract price and accepted alternates. No bid shall be considered accepted until the Awarding Authority has issued a written Notice of Award sent by mail or delivered to the address given by the successful bidder on its bid form.
 - 1. Definition of "Lowest Responsible and Eligible Bidder" : Attention is directed to the provisions of MGL Chapter 149 Section 44A; defining the terms "responsible" and "eligible".
- C. If the bidder selected as the General Contractor fails to perform his agreement to execute the Contract in accordance with the terms of his General Bid and furnish a

July 11, 2018

performance bond and also a labor and materials or payment bond as stated in his General Bid, an award will be made to the next lowest responsible and eligible General Bidder, subject to the provisions of the aforesaid MGL Chapter 149, Sections 44A-44H. The thirty (30) day time limit will not apply to a second or subsequent award made after the expiration of the time limit with the consent of said next lowest responsible and eligible bidder and made because the original award made within the time limit was invalid, or because the general bidder fails to execute the general contract or to provide a performance bond and labor and materials or payment bond.

ARTICLE 16 - EXECUTION OF CONTRACTS

- A. All bidders' attention is called to the agreements and certifications made by general bidders and sub-bidders in the required FORM FOR GENERAL BID and FORM FOR SUB-BID, respectively.
- B. The contract between the General Contractor and each Subcontractor shall be in the form contained in the Contract Documents following these Instructions, as required by MGL Chapter 149, Section 44F.

ARTICLE 17 – PERFORMANCE AND PAYMENT BONDS

- A. Performance and Payment Bonds: The successful General Contractor is required to provide the Owner with a performance bond, and a labor and materials or payment bond, executed by a surety company licensed by the Division of Insurance and approved by the Owner. Bonds must be delivered to the Awarding Authority not later than the time of execution of the Contract. Each such bond will be in the amount of the total Contract price.
 - 1. An attorney-in-fact who executes the required bond on behalf of the surety must affix thereto a certified and current copy of his Power of Attorney.
- B. A performance and payment bond furnished by the Subcontractor at the request of a General Contractor set forth in the general bid form, shall be for the benefit of the General Contractor; shall secure the performance of the subcontract by the Subcontractor; and shall indemnify and hold harmless the General Contractor and the surety or sureties under the labor and materials or payment bond furnished by such General Contractor to the Awarding Authority against (1) any and all loss and expense arising out of any and all claims in connection with the performance of said subcontract which would be required to be paid under the labor and materials or payment bond furnished by the General Contractor to the Awarding Authority and (2) attorney's fees in the event that the Subcontractor, after notice, fails to assume the defense of and defend such claims.

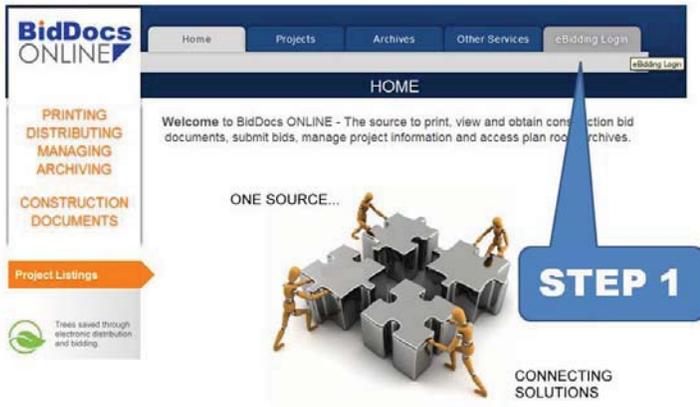
ARTICLE 18 - COMMENCEMENT OF WORK AND TIME OF COMPLETION

- A. It is agreed that time is of the essence of this Contract. The successful bidder, upon execution of the Contract Agreement, shall commence the work of the Contract within seven (7) calendar days from receipt of written Notice to Proceed issued by the Awarding Authority. The selected General Bidder shall agree to commence and prosecute the Work under this Contract in conformance with the conditions of the Contract Documents and shall thereafter diligently and continuously carry on the work without interruption in such manner as to

substantially complete the work of each phase in accordance with the Contract Documents.

1. Delay Remedy: In the event that the Project is delayed for any reason, the Contractor shall not be eligible for any additional compensation or damages on account of such delay, and the sole remedy for the Contractor, and any subcontractor, for a delay not caused by the Contractor or its subcontractors shall be an extension of the Contract Time only. No party shall have any other rights or remedies against the Owner on account of any delay, and agrees, by submitting a bid, that it shall make no claim therefor.
2. The Contract Time may be extended due to suspensions, delays, interruptions or failures caused by the Owner as provided for by MGL Chapter 30, Sections 39O and 39P, and for changes in the scope of the Contract due to differing subsurface or latent physical conditions as provided for by MGL Chapter 30, Section 39N.

End of Document

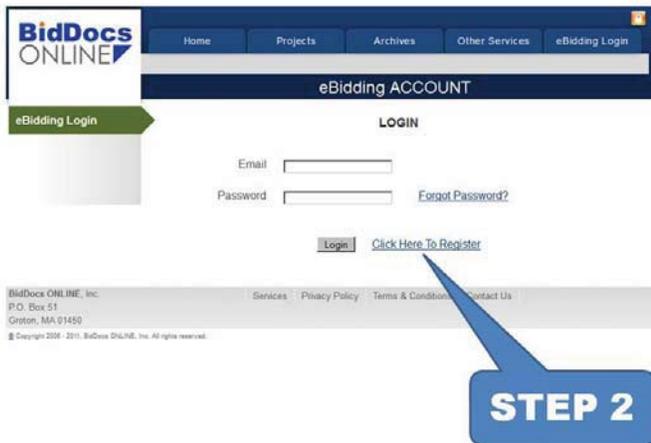


Tutorial #1 eBidding REGISTRATION INSTRUCTIONS

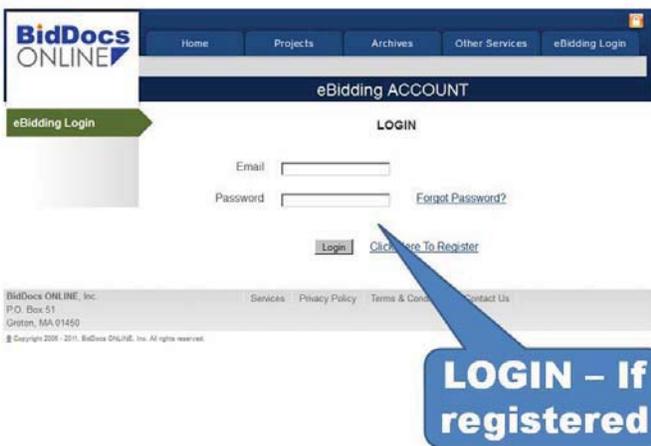
Below are the step by step instructions on how to register to use BidDocs ONLINE eBidding. There is no cost to register. Start by going to

www.biddocsonline.com

STEP 1: Click on the “eBidding Login” tab at the top of the page.



STEP 2: If your company has not previously registered, click on the text “[Click Here To Register](#)”.



STEP 3: If your company has previously registered, login by entering the registered email address and password and then click the “Login” button.

Note: Your company will have only one registration and must use the same password.

STEP 3

STEP 4

STEP 3: All fields must be completed in the registration form.

STEP 4: After completing the registration form, you must read and acknowledge the Terms and Conditions. Click the “Submit” button.

STEP 5

STEP 5: Enter the email and password previously created during the registration process and click “Login”.

STEP 6

STEP 6: After logging in, the account authorization screen will appear. You must click “Print Form” to proceed to Step 7.

STEP 7: Print and notarize the form (sign in blue ink). Return the original “Electronic Bidder Signature Authorization Form” to BidDocs ONLINE Inc.

The mailing address is:
BidDocs ONLINE Inc.
P.O. Box 51
61 Skyfields Drive (for overnight)
Groton, MA 01450

Your company is responsible for ensuring that BidDocs ONLINE receives the signed Electronic Bidder Signature Authorization Form a minimum of three (3) business days prior to the bid date. BidDocs ONLINE will notify you by email that your form has been received and processed. A unique bar code will identify your bid paperwork.

Note: The registration form will remain “active” until such time that your company requests a change in the person signing the form, the company address or other pertinent company information. Your company is responsible for printing and resubmitting an updated form as required.

STEP 8: While the Electronic Bidder Signature Authorization Form is being processed, you may commence completing the common forms (*DCAM Eligibility and Sections 1-4 of the DCAM Update Statement*) that are required for MGL c. 149 bids. (*See Tutorial #2 - eBidding Common Forms Instructions*)

Please note that you are responsible for completing the associated forms for each sub-trade and/or general bid as applicable.

Summary: THIS PROJECT IS BEING ELECTRONICALLY BID AND HARD COPY BIDS WILL NOT BE ACCEPTED BY THE AWARDING AUTHORITY. You must submit your bid electronically at www.biddocsonline.com. At any time during the bidding process, you may print the various bid documents for your company’s records. Additional instructions to complete the other bid forms are accessible on the BidDocs ONLINE website (click on the “Tutorial” tab at the bottom footer).

**DO NOT REMOVE
THIS PAGE INTENTIONALLY LEFT BLANK**

FORM FOR GENERAL BID

TO THE AWARDING AUTHORITY

A. The undersigned proposes to furnish all labor and materials required for _____ for the
PROJECT
in _____, Massachusetts,
in accordance with the accompanying plans and specifications prepared by _____

Name of Engineer/Architect

For the contract price specified below, subject to additions and deductions according to the terms of the specifications.

B. This bid includes addenda numbered: _____

C. The proposed contract price is:

Dollars \$ _____

Bid Amount in Words	Bid Amount in Numbers
---------------------	-----------------------

For Alternate	No. _____	Add \$ _____	Subtract \$ _____
	No. _____	\$ _____	\$ _____
	No. _____	\$ _____	\$ _____
	No. _____	\$ _____	\$ _____
	No. _____	\$ _____	\$ _____

Each Alternate shall be listed separately

D. The subdivision of the proposed contract price is as follows:

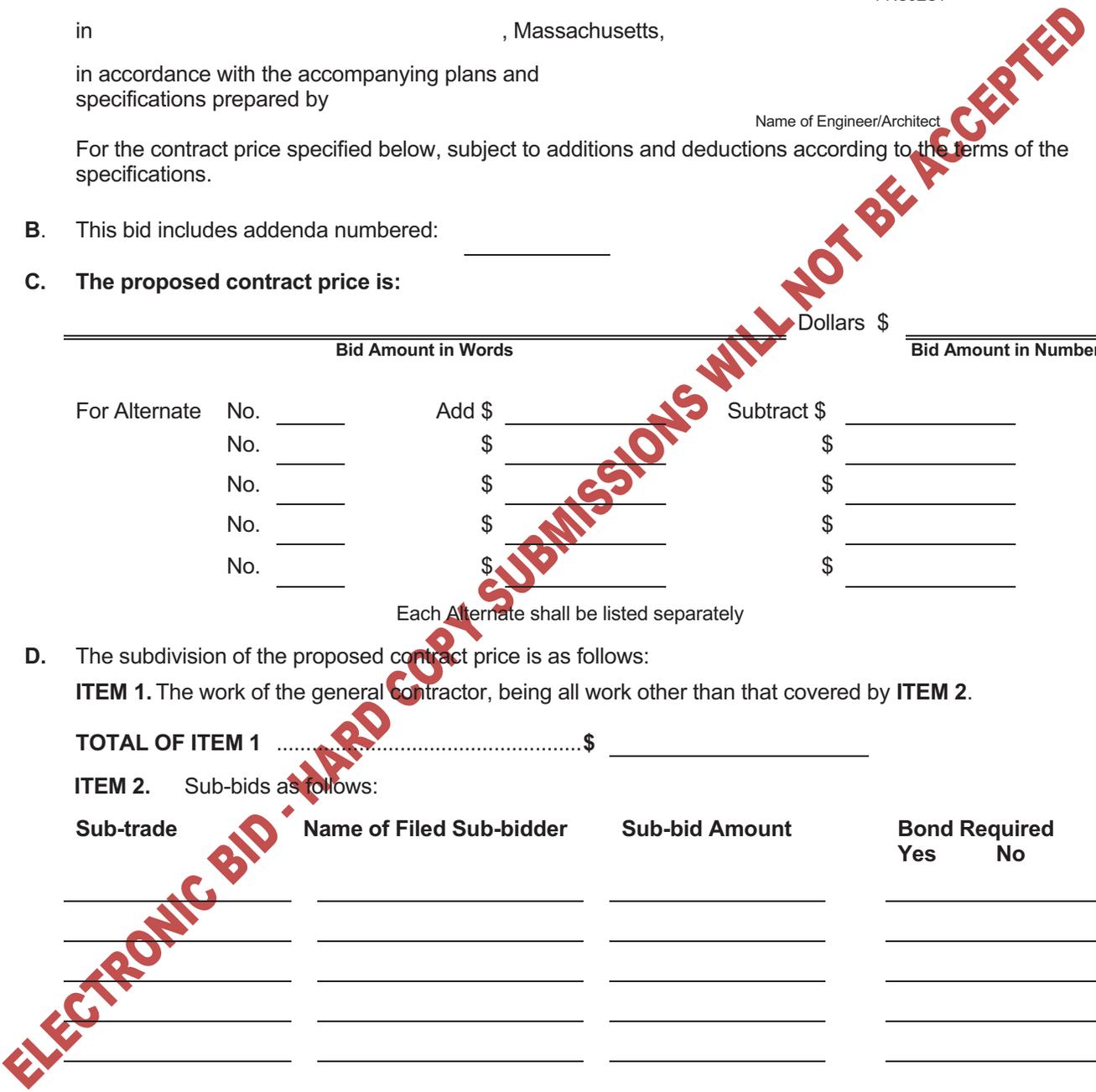
ITEM 1. The work of the general contractor, being all work other than that covered by **ITEM 2.**

TOTAL OF ITEM 1\$ _____

ITEM 2. Sub-bids as follows:

Sub-trade	Name of Filed Sub-bidder	Sub-bid Amount	Bond Required	
			Yes	No
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

TOTAL OF ITEM 2\$ _____



The undersigned agrees that each of the above named sub-bidders will be used for the work indicated at the amount stated, unless a substitution is made. The undersigned further agrees to pay the premiums for the performance and payment bonds furnished by sub-bidders as requested herein and that all of the cost of all such premiums is included in the amount set forth in Item I of this bid.

The undersigned agrees that if selected as general contractor, he will promptly confer with the awarding authority on the question of sub-bidders; and that the awarding authority may substitute for any sub-bid listed above a sub-bid filed with the awarding authority by another sub-bidder for the sub-trade against whose standing and ability the undersigned makes no objection; and that the undersigned will use all such finally selected sub-bidders at the amounts named in their respective sub-bids and be in every way as responsible for them and their work as if they had been originally named in this general bid, the total contract price being adjusted to conform thereto.

- E. The undersigned agrees that, if he is selected as general contractor, he will within five days, Saturdays, Sundays, and legal holidays excluded, after presentation thereof by the awarding authority, execute a contract in accordance with the terms of this bid and furnish a performance bond and also a labor and materials or payment bond, each of a surety company qualified to do business under the laws of the Commonwealth and satisfactory to the awarding authority and each in the sum of the contract price, the premiums for which are to be paid by the general contractor and are included in the contract price; provided, however, that if there is more than 1 surety company, the surety companies shall be jointly and severally liable.

The undersigned hereby certifies that he is able to furnish labor that can work in harmony with all other elements of labor employed or to be employed on the work; that all employees to be employed at the worksite will have successfully completed a course in construction safety and health approved by the United States Occupational Safety and Health Administration that is at least 10 hours in duration at the time the employee begins work and who shall furnish documentation of successful completion of said course with the first certified payroll report for each employee; and that he will comply fully with all laws and regulations applicable to awards made subject to section 44A.

The undersigned further certifies under the penalties of perjury that this bid is in all respects bona fide, fair and made without collusion or fraud with any other person. As used in this subsection the word "person" shall mean natural person, joint venture, partnership, corporation or other business or legal entity. The undersigned further certifies under penalty of perjury that the said undersigned is not presently debarred from doing public construction work in the Commonwealth under the provisions of section twenty-nine F of chapter twenty-nine, or any other applicable debarment provisions of any other chapter of the General Laws or any rule or regulation promulgated there under.

NAME OF BIDDER

SIGNATURE AND TITLE OF PERSON SIGNING BID

Date:

BUSINESS ADDRESS

FORM FOR SUB-BID

TO ALL GENERAL BIDDERS EXCEPT THOSE EXCLUDED:

A. The undersigned proposes to furnish all labor and materials required for completing, in accordance with the hereinafter described plans, specifications and addenda, all the work specified in Section No _____ of the specifications and in any plans specified in such section

prepared by _____ for _____

for the _____ in, _____ Massachusetts,

for the contract sum of :

		Dollars \$	
For Alternate	No.	Bid Amount in Words	Bid Amount in Numbers
	_____	Add \$ _____	Subtract \$ _____
	_____	\$ _____	\$ _____
	_____	\$ _____	\$ _____
	_____	\$ _____	\$ _____

Each Alternate shall be listed separately.

B. This Sub-bid includes addenda numbered _____

C. This Sub-bid

May be used by any General Bidder Except:

May only be used by the following General Bidders:

To exclude general bidders, insert "X" in one box only and fill in blank following that box.
Do not answer C if no general bidders are excluded

D. The undersigned agrees that, if selected as a sub-bidder, he will, within five days, Saturdays, Sundays and legal holidays excluded, after presentation of a subcontract by the general bidder selected as the general contractor, execute with such general bidder a subcontract in accordance with the terms of this sub-bid, and contingent upon the execution of the general contract, and, if requested to do so in the general bid by such general bidder, who shall pay the premiums therefor, or if prequalification is required pursuant to Section 44D 3/4 , furnish a performance and payment bond of a surety company qualified to do business under the laws of the Commonwealth and satisfactory to the awarding authority, in the full sum of the subcontract price.

E. The names of all persons, firms and corporations furnishing to the undersigned labor or labor and materials for the class or classes or part thereof of work for which the provisions of the section of the specifications for this sub-trade require a listing in this paragraph, including the undersigned if customarily furnished by persons on his own payroll and in the absence of a contrary provision in the specifications, the name of each such class of work or part thereto and the bid price for such class of work or part thereof are:

NAME	CLASS OF WORK	BID PRICE
------	---------------	-----------

(Do not give bid price for any class or part thereof furnished by the undersigned).

- F. The undersigned agrees that the above list of bids of the undersigned represents bona fide bids based on hereinbefore described plans, specifications and addenda, and that, if the undersigned is awarded the contract, they will be used for the work indicated at the amounts stated, if satisfactory to the awarding authority.
- G. The undersigned further agrees to be bound to the general contractor by the terms of the hereinbefore described plans, specifications, including all general conditions stated therein, and addenda, and to assume toward him all the obligations and responsibilities that he, by those documents, assumes toward the owner.
- H. The undersigned offers the following information as evidence of his qualifications to perform the work as bid upon according to all the requirements of the plans and specifications:

1. Have been in business under present business name for _____ years
2. Ever failed to complete any work awarded? _____
3. List one or more recent buildings with names of general contractor and architect on which you served as subcontractor for work of similar character as required for the above-named building

Building Type	Architect	General Contractor	Contract Amount
_____	_____	_____	\$ _____
_____	_____	_____	\$ _____
_____	_____	_____	\$ _____

4. Bank Reference: _____

- I. The undersigned hereby certifies that he is able to furnish labor that can work in harmony with all other elements of labor employed or to be employed on the work; that all employees to be employed at the worksite will have successfully completed a course in construction safety and health approved by the United States Occupational Safety and Health Administration that is at least 10 hours in duration at the time the employee begins work and who shall furnish documentation of successful completion of said course with the first certified payroll report for each employee; and that he will comply fully with all laws and regulations applicable to awards of subcontracts subject to section 44F. **The safety training requirement in this paragraph is effective July 1, 2006.**

The undersigned further certifies under penalty of perjury that this sub-bid is in all respects bona fide, fair and made without collusion or fraud with any other person. As used in this subsection the word "person" shall mean any natural person, joint venture, partnership, corporation or other business or legal entity. The undersigned further certifies under penalty of perjury that the said undersigned is not presently debarred from doing public construction work in the Commonwealth under the provisions of section twenty-nine F of chapter twenty-nine, or any other applicable debarment provisions of any other chapter of the General Laws or any rule or regulation promulgated thereunder.

NAME OF SUB-BIDDER

SIGNATURE & TITLE OF PERSON SIGNING BID

BUSINESS ADDRESS

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)

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.

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.

July 11, 2018

POPE'S TAVERN
ADDITION/RENOVATION
Halifax, Massachusetts

Document 00 43 96
COMPANY INFORMATION
(Bid Form Attachment)

The following information is furnished by the bidder for the information of the Awarding Authority:

If a Corporation:

Incorporated in what state

President:

Treasurer:

Secretary:

If a foreign corporation [incorporated or organized under laws other than laws of the Commonwealth of Massachusetts], is the corporation registered with the Secretary of State of Massachusetts? Yes....., No.....

If the bidder is selected for the work referred to above, it is required under Massachusetts General Laws (MGL) Chapter 30 Section 39L to furnish to the Awarding Authority a certificate of the Secretary of State stating that the corporation has complied with all applicable requirements set forth in the General Laws of the Commonwealth of Massachusetts.

If a Partnership: [Name All Partners]

Name of Partner:

Residence

Name of Partner:

Residence

If an Individual doing business under a firm name:

Name of Firm:

Name of Individual:

Business Address:

Residence:

End of Document

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THIS PAGE INTENTIONALLY LEFT BLANK**

July 11, 2018

Document 00 45 19
NON-COLLUSION AFFIDAVIT

The undersigned, being first duly sworn, deposes and says that:

- (1) He is _____ of _____, the Bidder that has submitted the attached Bid;
- (2) He is fully informed respecting the preparation and contents of the attached Bid and of all pertinent circumstances respecting such Bid;
- (3) Such Bid is genuine and is not a collusive or sham Bid;
- (4) Neither the said Bidder nor any of its officers, partners, owners, agents, representatives, employees or parties in interest, including this affiant, has in any way colluded, conspired, connived or agreed, directly or indirectly with any other Bidder, firm or person to submit a collusive or sham Bid in connection with the Contract for which the attached Bid has been submitted or to refrain from bidding in connection with such Contract, or has in any manner, directly or indirectly, sought by agreement or collusion or communication or conference with any other Bidder, firm or person to fix the price or prices in the attached Bid or of any other Bidder, or to fix any overhead, profit or cost element of the Bid price or the Bid price of any other Bidder, or to secure through any collusion, conspiracy, connivance or unlawful agreement any advantage against the Owner, or any person interested in the proposed Contract; and
- (5) The price or prices quoted in the attached Bid are fair and proper and are not tainted by any collusion, conspiracy, connivance or unlawful agreement on the part of the Bidder or any of its agents, representatives, owners, employees, or parties in interest, including this affiant.
- (6) The undersigned certifies under penalties of perjury that this bid is in all respects bona fide, fair and made without collusion or fraud with any other person. As used herein, the word person shall mean any natural person, joint venture, partnership, corporation or other business or legal entity.

Signature: _____

Name of Person signing bid: _____

Name of Business: _____

Subscribed and sworn to before me

this _____ day of _____, 2018

(Title)

My commission expires _____

End of Document

**DO NOT REMOVE
THIS PAGE INTENTIONALLY LEFT BLANK**

July 11, 2018

POPE'S TAVERN
ADDITION/RENOVATION
Halifax, Massachusetts

Document 00 45 20
AFFIDAVIT OF COMPLIANCE
(Bid Form Attachment)

..... I,, President Clerk of

.....
(Name of Corporation)

whose principal office is located at

.....

.....

do hereby certify that the above named corporation has filed with the State Secretary all certificates and annual reports required by Massachusetts General Law (MGL) Chapter 156B Section 109 (business corporation), or by MGL Chapter 180, Section 26A (non-profit corporation) and all other applicable requirements contained in the General Laws of the Commonwealth of Massachusetts.

SIGNED UNDER PENALTIES OF PERJURY

thisday of, 2016

.....
(Signature of Responsible Corporate Officer)

..... Mass. Business Corp. Foreign Corp. Non-Profit Corp.

End of Document

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THIS PAGE INTENTIONALLY LEFT BLANK**

OWNER-CONTRACTOR AGREEMENT

This agreement made the ____ day of _____, 201__ by and between _____ **Housing Authority** hereinafter called the "Owner", and _____ hereinafter called the "Contractor"

 Name of Contractor

Witnesseth, that the Owner and the Contractor, for the consideration hereinunder named, agree as follows:

Article 1. Scope of Work: The Contractor shall perform all Work required by the Contract Documents for _____ referred to in the Contract Documents prepared by _____ acting as and referred to as the "Architect"

 Description of Project

 Architect/Engineer

Article 2. Time of Completion: The Contractor shall commence work under this Contract on the date specified in the written Notice to Proceed" and shall bring the Work to Substantial Completion ____ calendar days of said date

 Days

Damages for delays in the performance of the Work shall be in accordance with Article 9 of the General Conditions of the Contract.

Article 3. Contract Sum: The Owner shall pay the Contractor, in current funds, for the performance of the Work,

	Dollars \$	
Contract Amount in Words		Contract Amount in Dollars

The Contract Sum is divided as follows:

Item 1: The Work of the Contractor, being all Work other than that covered by Item 2 \$ _____

Item 2: Subcontractors as follows

	Section - Trade	Subcontractor	Amount
1	_____	_____	\$ _____
2	_____	_____	\$ _____
3	_____	_____	\$ _____
4	_____	_____	\$ _____
5	_____	_____	\$ _____
6	_____	_____	\$ _____
7	_____	_____	\$ _____
8	_____	_____	\$ _____
9	_____	_____	\$ _____
10	_____	_____	\$ _____
	Total for Item 2		\$ _____

Article 4. The Contract Documents: The following, together with this Agreement, form the Contract and all are as fully a part of the contract as if attached to this Agreement or repeated herein: The Advertisement, Bidding Documents, Contract Forms, Conditions of the Contract, and Specifications as enumerated in the Table of Contents, the drawings as enumerated in the List of Contract Drawings and all Modifications issued after execution of the Contract. Terms used in this Agreement which are defined in the Conditions of the Contract shall have the meanings designated in those Conditions.

Article 5. Alternates: The following Alternates have been accepted and their costs are included in the Contract Sum stated in Article 3 of this Agreement: **Alternate No(s): _____ through _____**

Article 6. REAP Certification: Pursuant to G.L. c.62(c) §49(a), the individual signing this Contract on behalf of the Contractor, hereby certifies, under the penalties of perjury, that to the best of their knowledge and belief the Contractor has complied with all laws of the Commonwealth relating to taxes, reporting of employees and contractors, and withholding and remitting child support.

Article 7. Worker Documentation Certification: In accordance with Executive Order 481 the undersigned further certifies under the penalties of perjury that the Contractor shall not knowingly use undocumented workers in connection with the performance of this contract; that pursuant to federal requirements, the Contractor shall verify the immigration status of all workers assigned to such contract without engaging in unlawful discrimination; and that it shall not knowingly or recklessly alter, falsify, or accept altered or falsified documents from any such worker(s). The Contractor understands and agrees that breach of any of these terms during the contract period may be regarded as a material breach, subjecting the Contractor to sanctions, including but not limited to monetary penalties, withholding of payments, contract suspension or termination.

Article 8. Conflict of Interest: The Contractor covenants, that (1) presently, there is no financial interest and shall not acquire any such interest, direct or indirect, which would conflict in any manner or degree with the performance of services required to be performed under this Agreement or which would violate M.G.L. c.268A, as amended; (2) in the performance of this Contract, no person having any such interest shall be employed by the Contractor or engaged as a subcontractor by the contractor; and (3) no partner or employee of the firm is related by blood or marriage to any Board Member or employee of the Awarding Authority

Article 9. Validation: This Contract will not be valid until signed by the Undersecretary of the Massachusetts Department of Housing and Community Development.

In Witness Whereof, the Parties Hereto Have Caused This Instrument to be Executed Under Seal.

CONTRACTOR ¹

AWARDING AUTHORITY

Town of Halifax

Name of Contractor

Address

By: _____
Signature and Seal

Witness _____

Signature and Seal

Title

Attest: _____

¹ If a Corporation, attach a notarized copy of the Corporate Vote authorizing signatory to sign Contract.

July 11, 2018

POPE'S TAVERN
ADDITION/RENOVATION
Halifax, Massachusetts

Document 00 53 00
FORM FOR SUB-CONTRACT
(Massachusetts Chapter 149 Section 44F)

THIS AGREEMENT made this day of 2018
by and between
a corporation organized and existing under the laws of
a partnership consisting of
an individual doing business as
hereinafter called the "Contractor" and
.....
a corporation organized and existing under the laws of
a partnership consisting of
an individual doing business as
hereinafter called the "Sub-contractor".

WITNESSETH that the Contractor and the Subcontractor for the considerations hereafter named,
agree as follows:

1. The Subcontractor agrees to furnish all labor and materials required for the completion of
all work specified in Section Numbers

.....
(Section number(s) for Sub-Trade as listed under the Advertisement for Bids)

of the Specifications for:

.....
(Name of Sub-Trade as listed under the Advertisement for Bids)

and the Drawings referred to therein and Addenda Numbers
for the POPE'S TAVERN ADDITION/RENOVATION, all as prepared by Winslow
Architects, Inc., Boston, Massachusetts for the sum of:

{ \$ }
(amount in numbers)

..... Dollars
(amount in words)

and the Contractor agrees to pay the Subcontractor said sum for said work. This price
includes the following alternates (and other items set forth in the sub-bid): Alternate

July 11, 2018

No(s). _____, _____, _____, _____, _____.

- (a) The Subcontractor agrees to be bound to the Contractor by the terms of, the herein before described Drawings, Specifications (including all General Conditions and Supplementary General Conditions stated therein) and Addenda No. and to assume to the Contractor all the obligations and responsibilities that the Contractor by those documents assumes to the hereinafter called the "Awarding Authority", except to the extent that provisions contained therein are by their terms or by law applicable only to the Contractor.
- (b) The Contractor agrees to be bound to the Subcontractor by the terms of the herein before described documents and to assume to the Subcontractor all the Obligations and responsibilities that the Awarding Authority by the terms of the herein before described documents assumes to the Contractor, except to the extent that provisions contained therein are by their terms or by law applicable only to the Awarding Authority.

- 2. The Contractor agrees to begin, prosecute, and complete the entire work specified by the Awarding Authority in an orderly manner so that the Subcontractor will be able to begin, prosecute, and complete the work described in this Subcontract; and, in consideration thereof, upon notice from the Contractor, either oral or in writing, the Subcontractor agrees to begin, prosecute, and complete the work described in this Subcontract in an orderly manner and with due consideration to the date or time specified by the Awarding Authority for the completion of the entire work.
- 3. The Subcontractor agrees to furnish to the Contractor within a reasonable time after the execution of this Subcontract, evidence of workmen's compensation insurance as required by law and evidence of public liability and property damage insurance of the type and in limits required to be *furnished to the Awarding Authority by the Contractor.
- 4. The Contractor agrees that no claim for services rendered or materials furnished by the Contractor to the Subcontractor shall be valid unless written notice thereof is given by the Contractor to the Subcontractor during the first ten (10) days of the calendar month following that in which the claim originated.
- 5. This Agreement is contingent upon the execution of a General Contract between the Contractor and the Awarding Authority for the complete work.

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

.....
(Seal Attest)

.....
(Name of Subcontractor)

.....
(Seal Attest)

.....
(Name of Contractor)

End of Document

July 11, 2018

POPE'S TAVERN
ADDITION/RENOVATION
Halifax, Massachusetts

Document 00 54 03

VOTE OF CORPORATION AUTHORIZING EXECUTION OF CONTRACT

At a meeting of the Board of Directors of _____

duly called and held on _____

and acting throughout, the following vote was duly adopted:

VOTED: That _____

of the corporation, be and hereby is authorized to affix the corporate seal, sign and deliver in the name

and behalf of the corporation a contract with _____

for the construction of _____

at _____

(\$ _____

to secure the performance of said contract and payment for labor and materials for each year of the term of the Contract, all in such form and on such terms and conditions as he, by the execution thereof, shall deem proper.

A true copy.

ATTEST:

Clerk of the Corporation

Countersignature: _____

In the event that the Clerk or Secretary is the same person as the Officer authorized to sign contract or instrument for the Corporation, this certificate must be countersigned by another officer of the Corporation.

End of Document

VOTE OF CORPORATION AUTHORIZING EXECUTION OF CONTRACT

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July 11, 2018

POPE'S TAVERN
ADDITION/RENOVATION
Halifax, Massachusetts

Document 00 54 04
STATEMENT OF TAX COMPLIANCE

Pursuant to Chapter 62C of Massachusetts General Laws, Section 49A (b), I,

(Name and Title)

authorized signatory for: _____
(Contracting Party)

whose principal place of business is at _____
(Street Address)

_____, do hereby
(City/Town, State)

certify under the pains and penalties of perjury that

_____ has complied
(Contracting Party)

with all laws of the Commonwealth of Massachusetts relating to taxes.

Date: _____

{Authorized Signature}

{Social Security Number or Federal Identification Number}

End of Document

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THIS PAGE INTENTIONALLY LEFT BLANK**

July 11, 2018

Document 00 54 05

STATEMENT OF OSHA TRAINING COMPLIANCE

(Attachment to Agreement Form – AIA A101 modified, Document 00 52 00)

Pursuant to M.G.L. c.30, §39S, any person submitting a bid for, or signing a contract to work on, a public building or public works project estimated to cost more than \$10,000 shall certify on the bid, or contract, under penalties of perjury, as follows:

(1) that he is able to furnish labor that can work in harmony with all other elements of labor employed or to be employed in the work;

(2) that all employees to be employed at the worksite will have successfully completed a course in construction safety and health approved by the United States Occupational Safety and Health Administration that is at least 10 hours in duration at the time the employee begins work and who shall furnish documentation of successful completion of said course with the first certified payroll report for each employee; and

(3) that all employees to be employed in the work subject to this bid have successfully completed a course in construction safety and health approved by the United States Occupational Safety and Health Administration that is at least 10 hours in duration.

I, _____, authorized signatory for _____, do hereby certify under the pains and penalties of perjury that all employees employed on the worksite, or in work subject to the bid, have successfully completed at least 10 hours of OSHA approved training.

Signature of Individual
or Corporate Name

By:

(Corporate Officers Name)

(Corporate Officers Title)

Social Security Number
or Federal Identification Number

Date

End of Document

STATEMENT OF OSHA TRAINING COMPLIANCE

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Document 00 54 22
 BID ATTACHMENT
 UNIT PRICES SCHEDULE

A. Unit prices: Should certain additional work be required, or should the quantities of certain classes of work be increased or decreased from those upon which the Bid is based, as authorized by the Owner, the undersigned agrees that the following supplemental unit prices represent the exact net amount per unit to be paid the Contractor (in the case of additions or increases) or credited to the Owner (in the case of decrease), without further adjustment for overhead, profit, insurance, compensation insurance or other direct or indirect expenses of the Contractor.

B. Schedule of Unit Prices

	Item	Spec. Section	Unit of Measure	Unit Cost	Bid Quantity	Bid Price
1.	Underpinning work per Structural Drawings Drawing S2.0, Detail 4	03 30 00	4 Linear Feet	\$.....	1	\$.....
2.	Roof Sheathing	06 16 00	Square Foot	\$.....	300	\$.....
3.	Sister Rafters	06 10 00	Each	\$.....	8	\$.....

End of Document

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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)

1

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:

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

Signature: _____

Name and

Title:

(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: _____



Additions and Deletions Report for **AIA[®] Document A312[™] – 2010**

This Additions and Deletions Report, as defined on page 1 of the associated document, reproduces below all text the author has added to the standard form AIA document in order to complete it, as well as any text the author may have added to or deleted from the original AIA text. Added text is shown underlined. Deleted text is indicated with a horizontal line through the original AIA text.

Note: This Additions and Deletions Report is provided for information purposes only and is not incorporated into or constitute any part of the associated AIA document. This Additions and Deletions Report and its associated document were generated simultaneously by AIA software at 15:00:27 on 03/04/2011.

PAGE 1

1

Certification of Document's Authenticity

AIA® Document D401™ – 2003

I, _____, hereby certify, to the best of my knowledge, information and belief, that I created the attached final document simultaneously with its associated Additions and Deletions Report and this certification at 15:00:27 on 03/04/2011 under Order No. 2108302635_1 from AIA Contract Documents software and that in preparing the attached final document I made no changes to the original text of AIA® Document A312™ – 2010, Performance Bond, as published by the AIA in its software, other than those additions and deletions shown in the associated Additions and Deletions Report.

(Signed)

(Title)

(Dated)



AIA[®]

Document A312 – 2010

Payment 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)

1

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:

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

Signature: _____

Name and

Title:

(FOR INFORMATION ONLY — Name, address and telephone)

AGENT or BROKER:

OWNER'S REPRESENTATIVE:

(Architect, Engineer or other party:)

ADDITIONS AND DELETIONS:

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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 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: _____

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PAGE 1

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Certification of Document's Authenticity

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I, _____, hereby certify, to the best of my knowledge, information and belief, that I created the attached final document simultaneously with its associated Additions and Deletions Report and this certification at 14:59:31 on 03/04/2011 under Order No. 2108302635_1 from AIA Contract Documents software and that in preparing the attached final document I made no changes to the original text of AIA® Document A312™ – 2010, Payment Bond, as published by the AIA in its software, other than those additions and deletions shown in the associated Additions and Deletions Report.

(Signed)

(Title)

(Dated)

July 11, 2018

POPE'S TAVERN
ADDITION/RENOVATION
Halifax, Massachusetts

Document 00 62 12
PRODUCT SUBMITTAL FORM

Complete this 2-page document attached to ALL submittals for the Project. Use additional sheets as needed. Attach cut sheets, technical data sheets, materials safety data sheets, and other documentation supporting product data.

General Submittal Information:

Pope's Tavern
Addition/Renovation
Halifax, Masachusetts

Date submitted: _____

Submittal #: _____

Resubmittal:: R-__ _____

Architect:

Winslow Architects, Inc..
89 Massachusetts Avenue
Arlington, Massachusetts 02474

Specification Section Reference: _____

Page: _____ Article: _____

Drawing Number Reference: _____

General Contractor:

Detail Number: _____

Quantity submitted:

Reproducibles: ____ Prints: _____

Filed- Subcontractor /or/ subcontractor:

Standard References (ANSI, ASTM, FS, etc)

Vendor:

Attachments *:

- Product Data
- Warranties
- Drawings
- MSDS
- Samples
- Schedules
- Reports
- Calculations
- Tests
- 3rd. Party Certification

Product Information:

Product Description/Name: _____

Specified Manufacturer: _____ model #: _____

Deviation from contract documents?:

- NO Deviations
- YES (attach complete documentation)

Lead time after approval: _____

Date items required at project: _____

July 11, 2018

Submitted Manufacturer: _____ model #: _____
(company name & address)

Manufacturer's Phone #: _____

Deviation from contract documents?:
 NO Deviations YES (attach complete documentation)

Lead time after approval: _____

Date items required at project: _____

REVIEW STAMPS

GENERAL CONTRACTOR:

- ARCHITECT**
- Reviewed and Approved
 - Reviewed and Approved, Except as Noted
 - Resubmission Required
 - Disapproved

COMMENTS: _____

- CONSULTANT**
- Reviewed
 - Rejected
 - Furnish As Corrected
 - Revise and Resubmit

COMMENTS: _____

DISTRIBUTION AND COORDINATION

Project File: _____ Owner's Project Manager: _____
Site Office: _____ Resident Engineer / Clerk: _____
: _____ : _____

End of Document

July 11, 2018

POPE'S TAVERN
ADDITION/RENOVATION
Halifax, Massachusetts

Document 00 63 13
REQUEST FOR INTERPRETATION (RFI) FORM

Date Submitted: _____

To the Architect: Winslow Architects, Inc.
89 Massachusetts Avenue
Arlington, Massachusetts 02474

Architect's Assigned
RFI #

A/E Project Number: 16-514

Submitted By: Company: _____
Address _____

References: Specification Section Number: _____
Article/ Paragraph / Subparagraph: _____
Drawing Number: _____
Detail Number: _____

Request: _____
 Refer to Attachment(s) _____

Signed By: _____

Response: _____

Refer to Attachment(s)

Response From: _____

Signed by: _____

Copies to: Owner Consultants _____
 _____ _____ _____
 _____ _____ File

Date Received at
Architect

Date Returned by
Architect

End of Document

**DO NOT REMOVE
THIS PAGE INTENTIONALLY LEFT BLANK**

July 11, 2018

POPE'S TAVERN
ADDITION/RENOVATION
Halifax, Massachusetts

Document 00 63 25
SUBSTITUTION REQUEST FORM

Date Submitted: _____ Architect's Project Number: 16-514

Project: _____

To the Architect: Winslow Architects, Inc.
89 Massachusetts Avenue
Arlington, Massachusetts 02474

Submitted By: Company Name: _____

.....
The General Contractor proposes the following substitution in accordance with Massachusetts General Laws, Chapter 30, Section 39M(b), and the requirements of the Contract Documents:

References: **Specification Section Number:** ----- _____
Article / Paragraph / Subparagraph:--- _____
Drawing Number: ----- _____
Detail Number: ----- _____

Scope of Substitution: _____

Impact on Project Schedule None Yes [Add] [Deduct] # of Calendar Days _____

Impact on Related Work: None Yes - explain: _____

.....
List all Deviations from specified requirements: _____

Attach Additional Sheets if necessary to describe deviations

.....
Attachments: Attach supporting documentation sufficient for Architect to evaluate substitution. Substitution Request Forms submitted without adequate documentation will be returned without review.

Attachments: Drawings Product Data Reports _____
 Samples Warranties Tests _____

In addition to specific product information, attachments shall address the following issues:
• Manufacturer's Name, Address and Phone Number. • Age of product availability in US marketplace
• Point by point comparative with specified product. • List of 3 Similar installations, include Project Name, A/E and A/E phone number

.....
Response Date: List date by which response by Architect is requested to maintain project schedule and allow sufficient time for inclusion of proposed substitution.

July 11, 2018

POPE'S TAVERN
ADDITION/RENOVATION
Halifax, Massachusetts

Requested Response Date *: _____
* shall be not less than 10 working days from date substitution request is received.

Contractor's Certification: The Contractor certifies substitution complies with the project requirements and with the General Conditions by initiating each line below:

Investigation: ----- _____

Warranties and Guarantees: ----- _____

Cost Data:----- _____

Coordination of Substitute:----- _____

Submitted by:
(company name & address)

Authorized Signature

Notations listed below shall have the same meaning as on Architect's review stamp.
Clarifications to or changes in project schedule or time shall be processed using standard project forms.

Architect's Response:

Reviewed and Approved: ----- _____

Reviewed and Approved, Except as Noted:----- _____

Resubmission Required: ----- _____

Disapproved: ----- _____

Remarks:

Date:

Signed:

End of Document

Section 00.72.00
GENERAL CONDITIONS OF THE CONTRACT FOR CONSTRUCTION

ARTICLE	TABLE OF CONTENTS	PAGE
1.	GENERAL PROVISIONS	1
2.	OWNER	2
3.	DEPARTMENT	3
4.	CONTRACTOR	4
5.	ADMINISTRATION OF THE CONTRACT	10
6.	SUBCONTRACTORS	11
7.	CONSTRUCTION BY OWNER OR SEPARATE CONTRACT	12
8.	CHANGES IN THE WORK	12
9.	TIME, SCHEDULE, AND COMPLETION	15
10.	PAYMENTS	19
11.	GUARANTEES AND WARRANTIES	23
12.	MISCELLANEOUS LEGAL REQUIREMENTS	24
13.	CONTRACTOR'S ACCOUNTING REQUIREMENTS	25
14.	EQUAL EMPLOYMENT OPPORTUNITY REQUIREMENTS	27
15.	MBE-WBE SUPPLIER DIVERSITY PROGRAM	27
16.	INSURANCE	27
17.	INDEMNIFICATION	29
18.	PERFORMANCE AND PAYMENT BONDS	29
19.	TERMINATION	30

INDEX

	-A-		-H-
Acceptance of Work	9.5.4	Hazardous Materials	4.17.4
Access to Work	3.3.4, 4.9.5, 4.21.1, 7.2.1		-I-
Acts and Omissions	4.2.1, 4.2.2, 4.3.4, 4.7.9, 10.8, 17.1	Indemnification.....	Article 17
Addenda	1.1.1, 4.15.1	Information Provided by Owner	2.2, 4.2.1
Administration of Contract.....	Article 5	Inspections	4.16.1, 5.3.7
Administrator	2.3.2, 3.1.2, 3.1.3, 3.3.1, 3.3.3, 8.1.5, 8.7.1, 8.7.2, 19.4	Instructions to Bidders	1.1.1, 15.2.1, 15.4.3
		Insurance.....	Article 16
Advertisement or Invitation to Bid	1.1.1		-M-
Prime Designer, Definition of.....	5.1, 5.1.1	MBE/WBE.....	Article 15
Prime Designer's Approval	4.7.6, 4.7.7, 4.7.9, 5.3.5, 8.1.2, 8.1.3, 8.1.4	Methods, Means, Sequences	4.3.1, 8.6.2.2
Prime Designer's Decision	4.3.7, 4.8.1, 4.11.1, 5.3.10, 8.3.1.3, 8.6.3.1, 8.7.1, 8.7.2, 9.3.3.2.2, 9.6.4, 9.7.1, 9.7.2, 10.4, 10.5		-N-
Prime Designer's Inspection.....	4.3.7, 4.3.8, 4.8.2, 4.9.3, 4.9.4.4.12.1, 5.3.7, 9.3.2.1, 9.6.3	Notice to Proceed	9.1.2, 9.5.1, 14.4.3
Prime Designer's Interpretations	3.3.2, 4.19.1, 5.3.9, 8.5.1		-O-
Prime Designer's Authorization to Reject Work	4.8.1, 4.11.1, 4.12.1, 5.3.4	Occupancy	4.16.1, 5.3.7
Prime Designer's Site Visits	5.3.2, 5.3.7	Owner	Article 2
Aesthetic Effect	5.3.10		-P-
Authority (Awarding Authority).....	See Owner	Payments	2.4.2, 3.3.3, 4.9.6, 4.12, 5.3.3, Article 10, 14.6.2.2, 15.5.1, 15.5.2, 17.1, 19.2, 19.3
		Payments, Application for	5.3.3, 10.2.1, 10.3, 10.4, 10.5, 10.6
		Payments, Certification of	5.3.7, 10.5, 10.6
		Payment, Final	3.3.1, 5.3.1, 5.3.7, 9.3.3.4, 10.7, 11.2.1, 13.2, 13.4, 16.1
	-B-	Permits	4.16
Bonds	6.2.1.2, 8.3.1.3(g), 9.7.4, 15.4.5, 18	Product Data.....	4.7, 4.15, 5.3.5
		Project Representative	5.3.8, 8.7.3, 9.3.2.1
	-C-		-R-
Change Orders	1.1.1, 2.4.2, 3.3.1.2, 4.15.1, 5.3.6, 8.1.1, 8.1.2, 8.1.4, 8.1.5, 8.2.1, 8.3.1, 8.5.1, 8.6, 8.7.1, 9.1.1, 9.3.1, 9.3.2.1, 9.3.3.6, 9.7.1, 10.3.1.4, 18.2	Retainage	10.3.1, 10.6.2
Claims for Additional Costs	7.1.1, 8.7, 10.7.2, 17.1, 19.3.2		-S-
Claims for Additional Time.....	7.1.1, 8.7	Safety.....	4.20
Cleaning Up.....	4.17.1	Samples.....	4.7, 4.8, 4.15, 5.3.5
Completion (Substantial/Final) 3.3.1.6, 4.11.1, 5.3.7, 9.2.2, 9.6.1, 9.7		Schedule of Values	10.2
Conflict of Interest.....	12.8	Schedule, Construction	4.15.1, 5.5, 7.1.2, 9.4
Construction Advisor	3.1.3, 8.1.4, 8.4.1	Schedule, Payment.....	9.4
Construction Change Directive	1.1.1, 3.3.1.2, 5.3.6, 8.1.1, 9.7	Schedule, Participation.....	15.2.1, 15.4.1, 15.4.2, 15.4.3, 15.4.4, 15.4.6, 15.4.7, 15.4.9, 15.5.1
Construction Handbook	1.1.1, 1.1.7, 3.1.3, 5.3.8, 5.4.1, 8.7.4, 10.3.1	Site.....	1.2.1, 2.2.2, 4.4.1, 4.4.2, 4.8.2, 4.9.1, 4.9.2, 4.9.3, 4.9.4, 4.12, 4.15, 4.17.2, 4.17.3, 4.17.4, 4.18, 4.20.3, 4.21.1, 5.3.2, 5.3.8, 6.1.1, 7.1.1, 8.6.2, 10.4.1, 10.6.1.1, 12.4.1, 14.3.4, 19.1.4
Construction by Owner or by Separate Contractors	1.1.4, Article 7	SDO.....	Article 15
Construction Schedule.....	4.15.1, 7.1.2, 9.4.1	Specifications	1.1.1, 1.1.6, 1.3, 4.3.3, 4.7.5, 4.15, 5.3.5, 8.6.3, 9.4.1, 10.2.2, 10.7.1, 11.2.1, 12.4.1
Contract Documents	1.1	Stored Materials	4.9.4, 4.9.6, 10.4
Contract, Owner Contractor Agreement.....	1.1.1, 1.2.1, 2.1.1, 3.2.1, 3.3.1, 6.2.1, 8.6, 9.3.3.1, 9.3.3.3, 10.1.1, 10.8.2	Subcontractors.....	Article 6
Contract Sum.....	3.3.1, 8.1.1, 8.1.3, 8.2.1, 8.3.1, 8.4.1, 8.6.2.2, 9.3.3.3, 9.5.7, 10.1.1, 14.6.2.1, 15.1.12, 15.3.4	Submittals.....	4.2.3, 4.7, 4.15, 5.3.5
Contract Time.....	3.3.1, 8.1.1, 8.1.3, 8.2.1, 8.4.1, 9.1.1, 9.2, 9.3.2.1, 9.3.3.1	Substantial Completion	5.3.7, 9.6
Contractor.....	Article 4	Substitutions, Materials (or equals)	4.6.3, 4.7.5, 4.10.1
Cutting And Patching.....	4.3	Superintendent.....	4.4, 4.20.3, 8.7.3
		Supervision & Construction Procedures.....	4.3, 8.3.1
	-D-	Surety.....	6.2.1, 9.7.4, 15.4.5, 15.5.3, Article 18, 19.1.5
Damage to Work	9.6.7	Surveys.....	2.2.2
Delays/Extensions of Time	4.6.3.3, 4.8.2, 9.3		-T-
(DÉP) Department of Environmental Protection	4.17.4, 4.20.2, 4.20.3	Taxes	4.14
(DLWD) Department of Labor & Workforce Development	4.20.2, 12.4, 12.5	Termination	3.3.1, 6.2.1, 14.2.1, 14.2.2, 14.6.2.3, 15.4.6, 15.5.3
Disputes	8.7.3, 9.3.1	Testing & Inspection	4.8
Drawings.....	1.1.1, 1.1.5, 1.3, 2.2.1, 4.7, 4.15		-U-
		Unit Prices	8.3.1
	-E-		-W-
Equal Employment Opportunity.....	Article 14	Warranties	4.10, 5.3.7, 9.6.8, Article 11
Executive Orders	12.7	Weather Protection	4.18
	-F-		
Filed Subcontractors.....	6.1.3, 8.3.1, 10.6.2.1		
Final Completion	5.3.7, 9.5.4, 9.7		
Final Payment	3.3.1.7, 5.3.1, 9.3.3.4, 10.6.1, 10.6.1.2, 10.7, 11.2.1, 13.2.1, 13.2.2, 13.4.1		
	-G-		
Guarantees.....	Article 11		

Section 00.72.00
GENERAL CONDITIONS OF THE CONTRACT FOR CONSTRUCTION

**ARTICLE 1
GENERAL PROVISIONS**

1.1 BASIC DEFINITIONS

1.1.1 THE CONTRACT DOCUMENTS

The Contract Documents consist of the Owner-Contractor Agreement, Advertisement, Instructions to Bidders, Bidding Documents, Contract Forms, Conditions of the Contract, Specifications, Drawings, all addenda issued prior to execution of the Contract, and other documents listed in the Agreement and Modifications issued after execution of the Contract. A Modification is (1) a written amendment to the Contract signed by both parties, (2) a Change Order, (3) a Construction Change Directive or (4) a written order for a minor change in the Work issued by the Prime Designer.

1.1.2 THE CONTRACT

The Contract Documents form the Contract for Construction. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations or agreements, either written or oral. The Contract may be amended or modified only by a Modification.

1.1.3 THE WORK

The term "Work" means the construction and services required by the Contract Documents, whether completed or partially completed, and includes all other labor, materials, equipment, and services provided or to be provided by the Contractor to fulfill the Contractor's obligations. The Work may constitute the whole or a part of the Project.

1.1.4 THE PROJECT

The Project is the total construction of which the Work performed under the Contract Documents may be the whole or a part and which may include construction by the Owner or by separate contractors.

1.1.5 THE DRAWINGS

The Drawings are the graphic and pictorial portions of the Contract Documents, wherever located and whenever issued, showing the design, location and dimensions of the Work, generally including plans, elevations, sections, details, schedules, and diagrams.

1.1.6 THE SPECIFICATIONS

The Specifications are that portion of the Contract Documents consisting of the written requirements for materials, equipment, construction systems, standards, and workmanship for the Work, and performance of related services.

1.1.7 N/A

1.2 EXECUTION, CORRELATION, AND INTENT

1.2.1 Execution of the Contract by the Contractor is a representation that the Contractor has visited the site, become familiar with local conditions under which the Work is to be performed and correlated personal observations with requirements of the Contract Documents.

1.2.2 The intent of the Contract Documents is to include all items necessary for the proper execution and completion of the Work by the Contractor. The Contract Documents are complementary, and what is

required by one shall be as binding as if required by all. Performance by the Contractor shall be required only to the extent consistent with the Contract Documents and reasonably inferable from them as being necessary to produce the intended results. In case of inconsistent requirements in the Contract Documents, the requirement for the greater quantity or higher quality shall take precedence and shall be the Contract requirement.

1.2.3. Unless otherwise stated in the Contract Documents, words which have well known technical or construction industry meanings are used in the Contract Documents in accordance with such recognized meanings.

1.2.4. Where reference is made to standards or trade association publications, it shall be considered to refer to the latest edition and revision thereof, if any, in effect on the date the Contract Documents were advertised for bid.

1.3 USE OF DRAWINGS, SPECIFICATIONS, AND OTHER DOCUMENTS

The Drawings, Specifications and other documents prepared by the Prime Designer, 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 or for additions to this Project outside the scope of the Work without the specific written consent of the Owner, the Prime Designer, and the Owner.

ARTICLE 2 OWNER

2.1 DEFINITION

The term "Owner", sometimes also referred to as the "Awarding Authority" or "Authority", means the Town of Halifax.

2.2 INFORMATION AND SERVICES TO BE PROVIDED BY THE OWNER

2.2.1

Owner, through the Prime Designer, will furnish to the Contractor a digital file (PDF file) of drawings issued after the Contract has been awarded. The Contractor shall print and distribute such number of prints from this file as required for the Contractor's and Subcontractors' use.

2.2.2 The Owner shall furnish available surveys describing physical characteristics, legal limitations and utility locations for the site of the Project, and a legal description of the site.

2.3 OWNER'S RIGHT TO STOP THE WORK

2.3.1 If the Contractor fails to correct Work which is not in accordance with the requirements of the Contract Documents or persistently fails to carry out the Work in accordance with the Contract Documents, the Owner by written order signed personally or by its authorized agent, may order the Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated.

2.3.2 Stop work orders require the Administrators' prior approval. (See Subparagraph 3.1.2)

2.4 OWNER'S RIGHT TO CARRY OUT THE WORK

2.4.1 If the Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents and fails within a seven-day period after receipt of written notice from the Prime Designer at the Owner's direction to commence and continue correction of such default or neglect with diligence and promptness, the Owner may, without prejudice to other remedies, hire one or more contractors to correct such deficiencies.

2.4.2 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 Prime Designer's additional services and expenses made necessary by such default, neglect, or failure. If payments then or thereafter due the Contractor are not sufficient to cover such amounts, the Contractor shall pay the difference to the Owner.

ARTICLE 3 DEPARTMENT

3.1 DEFINITIONS

3.1.1 The term the "Owner" refers to the Town of Halifax and it's designated representative.

3.1.2 The term "Administrator" means the person appointed by the Owner to administer the terms of the Contract for Financial Assistance between the Owner and the Department, who is also empowered to take certain actions under this Agreement. Contractor should address mail to the Administrator c/o the Construction Management Unit.

3.1.3 The term "Construction Advisor" means the person designated by the Administrator to assist the Administrator. Also "owner's representative".

3.2 PROJECT FUNDING

The Work under this Contract is funded by the Commonwealth of Massachusetts through the Department pursuant to a contract for financial assistance between the Department and the Owner.

3.3 DEPARTMENT'S RESPONSIBILITIES

3.3.1 The Contractor is advised that various actions taken or decisions made by the Owner and/or the Prime Designer under this Contract, require the prior approval and counter-signature of the Administrator. Those actions or decisions include, but are not limited to, the following:

- .1 Approval, substitutions, and final selection of Sub-Bidders pursuant to M.G.L. c.149 §44F
- .2 Change Orders and Construction Change Directives, whether or not they affect a change in the Contract Sum or in the Contract Time.
- .3 Written orders, notices, and approvals given by the Owner pursuant to the Contract Documents or pursuant to any Laws applicable to this Contract, including approval of the Contractor's payment requests.
- .4 Approval of "or equal" submissions and substitutions pursuant to Subparagraph 4.6.3.
- .5 Stop Work order.
- .6 Certificate of Substantial Completion.
- .7 Final payment.
- .8 Termination of Contract.

3.3.2 In any instance where the Contractor requires clarification as to whose approval is required, the Prime Designer shall provide such clarification.

3.3.3 Work undertaken by the Contractor or a Subcontractor at the Owner's or other person's order without the Administrator's countersignature prior to the start of such work shall be considered unauthorized work and shall not be considered cause for extra payment. The Contractor or Subcontractor shall be responsible for performing, at their own expense, corrective measures required by the Prime Designer due to any failure to obtain the prior approval of the Administrator pursuant to Subparagraph 3.3.1.

3.3.4 The Owner and its authorized representatives and agents shall at all times have access to, and be permitted to observe and review all Work, materials, payrolls, records of personnel, conditions of

employment, invoices of materials, and other relevant data and records maintained by the Contractor on the Project.

ARTICLE 4 CONTRACTOR

4.1 DEFINITION

The Contractor, sometimes referred to as the General Contractor, is the person or entity identified as such throughout the Contract Documents as if singular in number. The term Contractor means the Contractor or its authorized representative.

4.2 REVIEW OF CONTRACT DOCUMENTS & FIELD CONDITIONS BY CONTRACTOR

4.2.1 The Contractor shall carefully study and compare the Contract Documents with each other and with information furnished by the Owner pursuant to Subparagraph 2.2.2 and shall at once report to the Prime Designer errors, inconsistencies, or omissions discovered. The Contractor shall not be liable to the Owner or Prime Designer for damage resulting from errors, inconsistencies, or omissions in the Contract Documents unless the Contractor recognized such error, inconsistency, or omission and knowingly failed to notify the Prime Designer. If the Contractor performs any construction activity knowing it involves a recognized error, inconsistency or omission in the Contract Documents without such notice to the Prime Designer, the Contractor shall assume responsibility for such performance and shall bear the attributable costs for correction.

4.2.2 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 Prime Designer at once.

4.2.3 The Contractor shall perform the Work in accordance with the Contract Documents and submittals approved pursuant to Paragraph 4.7.

4.3 SUPERVISION AND CONSTRUCTION PROCEDURES, COORDINATION, AND CUTTING AND PATCHING

4.3.1 The Contractor shall supervise and direct the Work, using the Contractor's best skill and attention. The Contractor shall be solely responsible for and have control over construction means, methods, techniques, sequences and procedures, and for coordinating all portions of the Work under the Contract.

4.3.2 The Contractor shall be responsible for the proper fitting of all Work and the coordination of the operations of all trades, Subcontractors, or material men engaged upon the Work.

4.3.3 All necessary cutting, coring, drilling, grouting, and patching required to fit together the several parts of the Work shall be done by the Contractor, except as may be specifically noted otherwise under any particular filed sub- id section of the Specifications.

4.3.4 The Contractor shall be responsible to the Owner for acts and omissions of the Contractor's employees, Subcontractors, and their agents and employees, and other persons performing portions of the Work.

4.3.5 The Contractor shall be responsible for inspection of portions of Work already performed under this Contract to determine that such portions are in proper condition to receive subsequent Work.

4.3.6 The Contractor shall do engineering required for establishing grades, lines, levels, dimensions, layouts, and reference points for the trades; shall be responsible for maintaining bench marks and other survey marks; and shall replace any bench marks or survey marks which have been disturbed or destroyed.

4.3.7 Unless otherwise required by the Contract Documents, or directed in writing by the Prime Designer, Work shall be done during regular working hours. However, if the Contractor desires to carry on the Work outside of regular working hours or on Saturdays, Sundays, or Massachusetts holidays it shall allow ample time to enable satisfactory arrangements to be made for inspecting Work in progress and shall bear the costs of such inspection. The Owner shall bill the Contractor directly for such costs.

4.3.8 Work done outside of regular working hours without the consent or knowledge of the Prime Designer shall be subject to additional inspection and testing as directed by the Prime Designer. The cost of this inspection and testing shall be paid by the Contractor whether the Work is found to be acceptable or not.

4.4 SUPERINTENDENT

4.4.1 The Contractor shall employ a Superintendent and necessary assistants who shall be in attendance at the Project site during performance of the Work. The Superintendent shall represent the Contractor, and communications given to the Superintendent shall be as binding as if given to the Contractor. Important communications shall be confirmed in writing. Other communications shall be similarly confirmed on written request in each case. The Superintendent shall attend each job meeting.

4.4.2 The Superintendent shall be a competent and responsible employee, satisfactory to the Owner, who is regularly employed by the Contractor and is designated by the Contractor as its representative to be in full time attendance at the Project site throughout the construction of the Work. The Superintendent shall be responsible for coordinating all the Work of the Contractor and the Subcontractors. The Superintendent shall be licensed consistent with the Massachusetts Building Code. The Superintendent's resume shall be submitted to the Owner prior to commencement of construction and must demonstrate to the Owner's reasonable satisfaction that the Superintendent has performed similar duties on previous construction projects similar to the Project.

4.5 LABOR

The Contractor shall enforce strict discipline and good order among the Contractor's employees and other persons carrying out the Work. The Contractor shall not permit employment of unfit persons or persons not skilled in tasks assigned to them, and whenever the Owner shall notify the Contractor, in writing, that any worker is, in its opinion, incompetent, unfaithful, disorderly, or otherwise unsatisfactory, such employee shall be discharged from the Work and shall not again be employed on the Project except with the consent of the Owner.

4.6 MATERIALS AND EQUIPMENT

4.6.1 Unless otherwise provided in the Contract Documents, the Contractor shall provide and pay for materials, equipment, tools, construction equipment and machinery, water, heat, utilities, transportation, and other facilities and services necessary for proper execution and completion of the Work, whether temporary or permanent and whether or not incorporated or to be incorporated in the Work.

4.6.2 Materials and Equipment to be installed as part of the Contract (both or either of which are hereinafter referred to as "Materials") shall be new, unused, of recent manufacture, assembled, and used in accordance with the best construction practices.

4.6.3 "OR EQUAL" SUBMISSIONS/SUBSTITUTIONS

4.6.3.1 Except where a product has been specified as a proprietary material, the words "or equal" are understood to follow the name of any maker, vendor, or product specified to be used in the Contract Documents. To determine if the materials or articles proposed by the Contractor are equal to those specified, the Prime Designer, with the concurrence of the Owner, shall determine whether the materials or articles proposed are at least equal in quality, durability, appearance, strength and design to the material or articles named or described, and will perform at least equally the functions imposed by the design. See M.G.L. c.30 §39M.

4.6.3.2 The Contractor shall be responsible for providing the Prime Designer with any information and test results the Prime Designer reasonably requires to determine if a material is equal to a material named or described in the Contract Documents.

4.6.3.3 Whenever the Contractor submits a material for approval as a substitute for a material named or described in the Contract Documents, such submission shall be made at least one hundred and twenty (120) days prior to the date the materials will be used on the Project but in no event later than ninety (90) days after the award of the Contract. In no event shall the Contractor maintain a claim for delays based upon the Prime Designer's review of such substituted materials if the Contractor has failed to comply with the one hundred and twenty (120) days submission requirement.

4.7 SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES

4.7.1 Shop Drawings are drawings, diagrams, schedules, and other data specially prepared for the Work by the Contractor or a Subcontractor, Sub-subcontractor, manufacturer, supplier, or distributor to illustrate a portion of the Work.

4.7.2 Product Data are illustrations, standard schedules, performance charts, instructions, brochures, diagrams and other information furnished by the Contractor or its Subcontractors and suppliers to illustrate materials or equipment for some portion of the Work.

4.7.3 Samples are physical examples which illustrate materials, equipment, or workmanship and establish standards by which the Work will be judged.

4.7.4 Shop Drawings, Product Data, Samples, and similar submittals are not Contract Documents. The purpose of their submission is to demonstrate for those portions of the Work for which submittals are required the way the Contractor proposes to conform to the information given and the design concept expressed in the Contract Documents. Review by the Prime Designer is subject to the limitations of Subparagraph 4.7.9.

4.7.5 The Contractor shall review, approve, and submit to the Prime Designer Shop Drawings, Product Data, Samples and similar submittals required by the Contract Documents with reasonable promptness and in such sequence as to cause no delay in the Work or in the activities of the Owner or of separate contractors. Submittals made by the Contractor which are not required by the Contract Documents may be returned without action. The Contractor's attention is directed to the provisions of Subparagraph 4.6.3 entitled "Or Equal" Submissions/Substitutions and Section 01.25.13 of the Specifications.

4.7.6 The Contractor shall prepare and keep current, for the Prime Designer's approval, a schedule of submittals which is coordinated with the Contractor's construction schedule submitted pursuant to Paragraph 9.4, and allows the Prime Designer reasonable time to review submittals.

4.7.7 The Contractor shall perform no portion of the Work requiring submittal and review of Shop Drawings, Product Data, Samples or similar submittals until the respective submittal has been approved by the Prime Designer. Such Work shall be in accordance with approved submittals.

4.7.8 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, or will do so, and has checked and coordinated the information contained within such submittals with the requirements of the Work and of the Contract Documents.

4.7.9 The Contractor shall not be relieved of responsibility for deviations from requirements of the Contract Documents by the Prime Designer's approval of Shop Drawings, Product Data, Samples or similar submittals unless the Contractor has specifically informed the Prime Designer in writing of such deviation at the time of submittal and the Department has given explicit written approval to the specific deviation. The Contractor shall not be relieved of responsibility for errors or omissions in Shop Drawings, Product Data, Samples, or similar submittals by the Prime Designer's actions.

4.7.10 The Contractor shall direct specific attention, in writing or on resubmitted Shop Drawings, Product Data, Samples or similar submittals, to revisions other than those requested by the Prime Designer on previous submittals.

4.7.11 Informational submittals upon which the Prime Designer is not expected to take responsive action may be so identified in the Contract Documents.

4.7.12 When professional certification of performance criteria of materials, systems or equipment is required by the Contract Documents, the Prime Designer shall be entitled to rely upon the accuracy and completeness of such calculations and certifications.

4.8 SAMPLES AND TESTS

4.8.1 Materials to be used in the Work may be tested or inspected after reasonable notice by the Prime Designer and may be rejected if they fail the specified tests. Except as otherwise provided in the Contract, all testing of material specifically requested by the Prime Designer will be paid for by the Owner, except that the cost of testing of materials that fail the testing criteria shall be borne by the Contractor. If the Contractor requests permission to use a material that was not specified in the Contract Documents and the Prime Designer requires testing of such material before approving its use, the Contractor shall pay for such testing.

4.8.2 The source of material proposed by the Contractor shall be designated in time to permit all required testing and inspection before the material is needed for incorporation into the Work. The Contractor shall have no claim for delays due to testing if it fails to designate the proposed source or to order the material in time to provide for adequate testing and inspection. Necessary arrangements shall be made to permit the Prime Designer to make factory, shop, or other inspection of materials or equipment ordered for the Work, in process of manufacture or fabrication, or in storage elsewhere than the site of the Work.

4.8.3 The Contractor shall furnish the Prime Designer with samples of the materials it proposes to use in the execution of the work in sufficient time to afford the Prime Designer the opportunity to adequately review and, if necessary, arrange for testing of such materials.

4.9 DELIVERY AND STORAGE OF MATERIALS

4.9.1 Materials and equipment shall be progressively delivered to the site so that there will be neither delay in the progress of the Work nor an undue accumulation of materials that are not to be used within a reasonable time.

4.9.2 Materials stored off-site shall be stored at the expense of the Contractor in a manner that preserves their quality and fitness for the Work. Material shall be placed on wooden platforms or other hard clean surfaces and not on the ground and shall be properly protected.

4.9.3 If the Contractor requests the Prime Designer's inspection of materials stored off-site, the Contractor shall assume the Prime Designer's reasonable costs for travel, room, and meals associated with such inspection.

4.9.4 Materials stored either at the site or at some other location agreed upon in writing shall be located so as to facilitate prompt inspection and may again be inspected prior to their use in the work.

4.9.5 The Contractor shall take charge of and be liable for any loss of or injury to the materials delivered at or in the vicinity of the place where the Work is being done and shall notify the Prime Designer as soon as any such materials are so delivered and allow them to be examined by the Prime Designer.

4.9.6 Payment for stored materials shall be made in accordance with Paragraph 10.4.

4.10 WARRANTY

The Contractor warrants to the Owner and Prime Designer that materials and equipment furnished under the Contract will be of good quality and new unless otherwise required or permitted by the Contract Documents, that the Work will be free from defects not inherent in the quality required or permitted, and

that the Work will conform with the requirements of the Contract Documents. Work not conforming to these requirements, including substitutions not properly approved and authorized, may be considered defective. If required by the Prime Designer, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment.

4.11 REJECTION OF DEFECTIVE MATERIALS

The Prime Designer may reject materials if the Prime Designer reasonably determines that such materials do not conform to the Contract Documents. No rejected materials, the defects of which have been subsequently corrected, shall be used in the Work except with the written permission of the Prime Designer. No extra time shall be allowed for completion of the Work due to the rejection of non-conforming materials.

4.12 REJECTION OF DEFECTIVE WORK

The Prime Designer's inspection of the Work shall not relieve the Contractor of any of its responsibilities to fulfill the Contract obligations, and defective work shall be corrected. Unsuitable work may be rejected by the Prime Designer, notwithstanding that such work and materials have been previously overlooked or misjudged by the Prime Designer and accepted for payment. If the Work or any part thereof shall be found defective at any time before the final acceptance of the whole Work, the Contractor shall forthwith correct such defect in a manner satisfactory to the Prime Designer, and if any material brought upon the site for use in the Work, or selected for the same, shall be rejected by the Prime Designer as unsuitable or not in conformity with the Contract requirements, the Contractor shall forthwith remove such materials from the vicinity of the Work.

4.13 MATERIALS ATTACHED OR AFFIXED TO THE WORK

Nothing in this Contract shall be construed as vesting in the Contractor any right of property in the materials used after they have been attached or affixed to the Work or the soil; but all such materials shall, upon being so attached or affixed, become the property of the Owner.

4.14 SALES TAX EXEMPTION AND OTHER TAXES

4.14.1 To the extent that materials and supplies are used or incorporated in the performance of this Contract, the Contractor is considered an exempt purchaser under the Massachusetts Sales Act, Chapter 14 of the Acts of 1966.

4.14.2 The Contractor shall be responsible for paying all other taxes and tariffs of any sort, related to the work.

4.15 DOCUMENTS AND SAMPLES AT THE SITE

The Contractor shall maintain at the site for the use and information of the Owner, one record copy of the Drawings, Specifications, Addenda, Change Orders, and other Contract Modifications, in good order and marked currently to record changes and selections made during construction, and in addition approved Shop Drawings, Product Data, Samples, updated construction schedule, and similar required submittals. These shall be available to the Prime Designer and shall be delivered to the Prime Designer for submittal to the Owner upon completion of the Work.

4.16 PERMITS, FEES, AND NOTICES

4.16.1 The Contractor (and the appropriate licensed subcontractor when applicable) shall secure and the Owner shall pay for any and all permits. The Contractor (and licensed subcontractor when applicable) shall secure and pay for all licenses, and other fees required for the proper execution of the Work. The Contractor shall coordinate all efforts required to obtain these permits including having the permit issued in the name of the Contractor or appropriate subcontractor.

4.16.2 The Contractor shall comply with and give notices required by laws, ordinances, rules, regulations and lawful orders of public authorities bearing on performance of the Work.

4.16.3 It is not the Contractor's responsibility to ascertain that the Contract Documents are in accordance with applicable laws, statutes, ordinances, building codes, and rules and regulations. However, if the

Contractor observes that portions of the Contract Documents are at variance therewith, the Contractor shall promptly notify the Prime Designer and Owner in writing, and necessary changes shall be accomplished by appropriate Modification.

4.16.4 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 Prime Designer and Owner, the Contractor shall assume full responsibility for such Work and shall bear the attributable costs.

4.17 DEBRIS, CHEMICAL WASTE

4.17.1 The Contractor shall not permit the accumulation of debris, both exterior and interior, and the work area shall at all times be kept satisfactorily clean.

4.17.2 The Contractor shall remove debris from the site of the work and legally dispose of it at any private or public dump that the Contractor may choose. The Contractor shall make all arrangements and obtain any approvals necessary for said disposal from the owners or officials in charge of such dumps and shall bear all cost, including fees resulting from such disposal. Garbage shall be removed daily.

4.17.3 No open fire shall be permitted on site.

4.17.4 Chemical Waste: Chemical waste shall be stored in corrosion resistant containers, removed from the Project site, and disposed of not less frequently than monthly unless directed otherwise. Disposal of chemical waste shall be in accordance with requirements of the U.S. Environmental Protection Agency (EPA) and the Massachusetts Department of Environmental Protection (DEP). Fueling and lubricating of vehicles and equipment shall be conducted in a manner that affords the maximum protection against spills and evaporation. Lubricants to be discarded or burned shall be disposed of in accordance with approved procedures meeting all applicable Federal, State and local regulations. In the event of an oil or hazardous materials spill large enough to violate Federal, State or applicable local regulations, the Prime Designer shall be notified immediately. The Contractor shall be responsible for immediately cleaning up any oil or hazardous waste spills resulting from its operations. Any costs incurred in cleaning up any such spills shall be borne by the Contractor.

4.18 SITE AND WEATHER PROTECTION

4.18.1 The Contractor shall take precaution during the execution of work involving demolition not to disturb or damage any existing structures, landscaping, walks, roads, or other items scheduled to remain. The Contractor shall restore any damaged items to original condition and as directed by the Prime Designer. The Contractor shall provide and erect acceptable barricades, fences, signs, and other traffic devices to protect the work from traffic and the public as reasonably necessary and as required by the Massachusetts Building Code.

4.18.2 The Contractor shall install weather protection and provide adequate heat in the protected area from November 1 to March 31 as required by M.G.L. c.149 §44G.

4.19 ARCHAEOLOGICAL AND HISTORICAL RESOURCES

All items having any apparent historical or archaeological interest which are discovered in the course of any construction activities shall be carefully preserved and reported immediately to the Prime Designer for determination of appropriate actions to be taken.

4.20 SAFETY REQUIREMENTS

4.20.1 The Contractor must comply with all Federal, State, and Local safety laws and regulations of the applicable to work performed under this Contract.

4.20.2 If the Contractor uses or stores toxic or hazardous substances it is subject to M.G.L. c.111F §2, the "Right to Know" law and regulations promulgated by the Department of Public Health, 105 CMR 670, the Department of Environmental Protection, 310 CMR 33, and the Department of Labor and Workforce Development, 441 CMR 21; and must post a Workplace Notice obtainable from the Department of Labor and Workforce Development.

4.20.3 The Contractor must comply with Dig-Safe Laws. Dig-Safe is the Utility Underground Plant Damage Prevention System, 331 Montvale Ave., Woburn, MA 01801, 1.888.344.7233. The Contractor must notify Dig-Safe of contemplated excavation, demolition, or explosive work in public or private ways, and in any utility company right of way or easement, by certified mail, with a copy to Department of Environmental Protection (DEP). This notice must be given at least 72 hours prior to the work, but not more than sixty days before the work is to be done. Such notice shall state the name of the street or the route number of the way and an accurate description of the location and nature of the proposed work. Dig-Safe is required to respond to the notice within 72 hours of receipt by designating the location of pipes, mains, wires or conduits at the site. The Contractor shall not commence work until Dig-Safe has responded. The work shall be performed in such manner and with reasonable precautions taken to avoid damage to utilities under the surface at the work location. The Contractor shall provide the Superintendent with current Dig-Safe regulations, and a copy of M.G.L. c.82 §40. Any costs related to the services performed by Dig-Safe shall be borne by the Contractor.

4.20.4 This project is subject to compliance with Public Law 92-596 "Occupational Safety and Health Act of 1970" (OSHA), with respect to all rules and regulations pertaining to construction, U.S. Code Title 29, sections 651 et seq. including Volume 36, numbers 75 and 105, of the Federal Register as amended, and as published by the U.S. Department of Labor.

4.20.5 If this Project requires the containment or removal of asbestos or material containing asbestos, lead or waste containing lead based paint, the Contractor shall ensure that the person or company performing the asbestos or lead related services is licensed pursuant to applicable State laws and regulations.

4.21 ACCESS TO WORK

The Contractor shall provide the Owner and Prime Designer access to the Work at all times and shall cooperate with the Owner whenever the Owner invites visitors to the site.

ARTICLE 5 ADMINISTRATION OF THE CONTRACT

5.1 PRIME DESIGNER

The Prime Designer is the person or entity licensed to practice architecture or engineering, who is responsible for performing the duties assigned to the Prime Designer by the Contract Documents.

5.2 COMMUNICATIONS FACILITATING CONTRACT ADMINISTRATION

Except as otherwise provided in the Contract Documents or when direct communications have been specially authorized, the Owner and Contractor shall communicate through the Prime Designer. Communications by and with the Prime Designer's consultants shall be through the Prime Designer. Communications by and with Subcontractors and material suppliers shall be through the Contractor. Communications by and with separate contractors shall be through the Owner.

5.3 PRIME DESIGNER'S ADMINISTRATION OF THE CONTRACT

5.3.1 The Prime Designer will provide administration of the Contract as described in the Contract Documents, and will be the Owner's representative (1) during construction, (2) until final payment is due and (3) with the Owner's concurrence, from time to time during the guaranty period described in Article 11. The Prime Designer will advise and consult with the Owner.

5.3.2 The Prime Designer will regularly visit the site, conduct job meetings and keep the Owner informed of the progress and quality of the Work, and will endeavor to guard the Owner against defects and deficiencies in the Work. The Prime Designer's minutes of meetings shall be the official minutes kept on the Project.

5.3.3 Based on the Prime Designer's observations and evaluations of the Contractor's Applications for Payment, the Prime Designer will review and certify the amounts due the Contractor and will submit to the Owner and the Department for their consideration Certificates for Payment in such amounts as the Prime Designer determines appropriate.

5.3.4 The Prime Designer shall reject Work which does not conform to the Contract Documents. Whenever the Prime Designer considers it necessary or advisable to achieve the intent of the Contract Documents, the Prime Designer will have authority to require additional inspection or testing of the Work in accordance with Paragraph 4.8.

5.3.5 The Prime Designer will review and approve or take other appropriate action upon the Contractor's submittals such as Shop Drawings, Product Data and Samples, but only for the limited purpose of checking such submittals for conformance with the information given and the design concept expressed in the Contract Documents. This review shall be in accordance with the provisions of Subparagraph 4.6.3 and the procedures described in Section 01.33.00 of the Specifications, and shall not relieve the Contractor from compliance with the requirements of the Contract Documents.

5.3.6 The Prime Designer will prepare Change Orders and Construction Change Directives, and may authorize Minor Changes in the Work as provided in Paragraph 8.1.

5.3.7 The Prime Designer will conduct inspections to determine the date or dates of Substantial Completion and the date of Final Completion, will receive and forward to the Owner for the Owner's review and records written warranties and related documents required by the Contract and assembled by the Contractor, and will issue a final Certificate for Payment upon the Contractor's compliance with the requirements of the Contract Documents.

5.3.8 If the Owner, Prime Designer _____ agree, the Owner may provide one or more project representatives to assist in carrying out the Prime Designer's responsibilities at the site.

5.3.9 The Prime Designer will interpret and decide matters concerning performance under and requirements of the Contract Documents on written request of either the Owner or Contractor. The Prime Designer's written response to such requests will be made within the thirty day time limit prescribed in Paragraph 8.6.3.

5.3.10 The Prime Designer's decisions on matters relating to aesthetic effect will be final if consistent with the intent expressed in the Contract Documents.

5.4 PROCEDURES AND PRACTICES

The Department's procedures, forms, and practices which must be employed on the Project are described in the Construction Handbook, and will be explained at the pre-construction conference.

5.5 PRECONSTRUCTION CONFERENCE

Prior to commencement of the Work, the Contractor shall meet in conference with representatives of the Owner, Department, and Prime Designer to discuss and develop mutual understandings relative to administration of the quality assurance program, safety program, labor provisions, the schedule of work, and other Contract procedures.

ARTICLE 6 SUBCONTRACTORS

6.1 DEFINITION

6.1.1 A Subcontractor is a person or entity who has a direct contract with the Contractor to perform a portion of the work at the site.

6.1.2 The Contractor shall require each Subcontractor to be bound to the Contractor by the terms of the Contract Documents, and to assume toward the Contractor all the obligations and responsibilities which the Contractor assumes toward the Owner and the Prime Designer.

6.1.3 Subcontracts between the Contractor and a filed sub-bidder shall be in the form required by M.G.L c.149 §44F.

6.2 CONTINGENT ASSIGNMENT OF SUBCONTRACTS

Each subcontract agreement for a portion of the Work is assigned by the Contractor to the Owner provided that:

6.2.1 assignment is effective only after termination of the Contract by the Owner for cause pursuant to Paragraph 19.1 and only for those subcontract agreements which the Owner accepts by notifying the Subcontractor in writing; and

6.2.2 assignment is subject to the prior rights of the surety obligated under bond relating to the Contract.

ARTICLE 7 CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

7.1 OWNER'S RIGHT TO PERFORM CONSTRUCTION AND TO AWARD SEPARATE CONTRACTS

7.1.1 The Owner reserves the right to perform construction or operations related to the Project with the Owner's own forces, and to award separate contracts in connection with other portions of the Project or other construction or operations on the site. If the Contractor claims that delay or additional cost is involved because of such action by the Owner, the Contractor shall make such claim as provided elsewhere in the Contract Documents.

7.1.2 The Owner shall provide for coordination of the activities of the Owner's own forces and of each separate contractor with the Work of the Contractor, who shall cooperate with them. The Contractor shall participate with other separate contractors and the Owner in reviewing and coordinating their construction schedules with one another when directed to do so.

7.2 MUTUAL RESPONSIBILITY

7.2.1 The Contractor shall afford the Owner and separate contractors reasonable opportunity for introduction and storage of their materials and equipment and performance of their activities and shall connect and coordinate the Contractor's construction and operations with theirs as required by the Contract Documents.

7.2.2 If part of the Contractor's Work depends on proper execution or results upon construction or operations by the Owner or a separate contractor, the Contractor shall, prior to proceeding with that portion of the Work, promptly report to the Prime Designer apparent discrepancies or defects in such other construction that would render it unsuitable for such proper execution and results. Failure of the Contractor to so report shall constitute an acknowledgment that the Owner's or separate contractors' completed or partially completed construction is fit and proper to receive the Contractor's Work, except as to defects not then reasonably discoverable.

7.2.3 The Contractor shall promptly remedy damage wrongfully caused by the Contractor to completed or partially completed construction or to property of the Owner or separate contractors.

ARTICLE 8 CHANGES IN THE WORK

8.1 CHANGES - DEFINITIONS

8.1.1 All changes in the work, including any increase, decrease, or other equitable adjustment in the Contract Sum or in the time for performing the Contract, shall be authorized in the form of one, or a combination of, the following written instruments: Change Order, Construction Change Directive, or a

Minor Change in the Work. The term "equitable adjustment" as used in this paragraph shall include all adjustments to the Contract Sum or time to which the Contractor is entitled pursuant to M.G.L. c.30 §§39N and 39O and such equitable adjustment shall be made in accordance with the provisions of this Article.

8.1.2 A Minor Change is a written order binding on the Owner and Contractor issued by the Prime Designer, with the concurrence of the Construction Advisor, not involving adjustment in the Contract Sum or extension of the Contract Time and not inconsistent with the intent of the Contract Documents. The Contractor shall carry out such written orders promptly.

8.1.3 A Change Order is a written instrument prepared by the Prime Designer and signed by the Owner, Department, Contractor, and Prime Designer, stating their agreement regarding a change in the work, including a change in the Contract Sum or Contract Time.

8.1.4 A Construction Change Directive is a written order prepared by the Prime Designer and signed by the Owner, Prime Designer, directing a change in the Work and stating a proposed basis for adjustment, if any, in the Contract Sum, or Contract Time, or both. The Owner may, by Construction Change Directive, and without invalidating the Contract, order changes in the Work within the general scope of the Contract consisting of additions, deletions or other revisions, the Contract Sum and Contract Time being adjusted accordingly.

8.1.5 A Change Order shall be based upon agreement among the Owner, Contractor, Prime Designer, and the Department, and may or may not be agreed to by the Contractor; an order for a Minor Change in the Work may be issued by the Prime Designer with the concurrence of the and Owner.

8.1.6 Change Orders and Construction Change Directives must be counter-signed by the Administrator in accordance with Subparagraph 3.3.1, to be effective.

8.2 REQUEST FOR A CHANGE IN THE WORK

A change order request shall be in writing and may originate with the Owner, the Prime Designer, or the Contractor. If such a request would cause a change in the Contract Sum, the Contractor shall promptly submit to the Prime Designer its cost and pricing data for such proposed change. Such data shall be accurate, current and complete at the time of submission and shall be computed in accordance with Subparagraph 8.3.1.

8.3 METHOD FOR DETERMINING AMOUNT OF CHANGE

8.3.1 Changes in the Contract Sum shall be calculated in accordance with one or a combination of the following methods, as determined by the Prime Designer:

- .1** Lump sum basis, provided the lump sum amount shall include the estimated cost of the change, broken down by Items a through i in the following Subparagraph .3.
- .2** Unit price basis, to be adjusted in accordance with contract unit prices, or other agreed upon unit prices provided that the unit prices shall be inclusive of all costs related to such equitable adjustment.
- .3** Time and materials basis, on a not-to-exceed predetermined upset amount determined by the Prime Designer, to be subsequently adjusted on the basis of the Contractor's actual costs based on the following items a through i:
 - a.** Cost of labor at the rates found elsewhere in this document, including foremen;
 - b.** Costs of materials, supplies and equipment, including cost of transportation, whether incorporated or consumed;
 - c.** Rental cost of machinery and equipment, exclusive of hand tools, whether rented from the Contractor or others.
 - d.** A percent of the net increase or decrease of Item a to cover Worker's Compensation, F.I.C.A., and unemployment contributions.
 - e.** The percentage for Worker's Compensation in Item d above shall not exceed the standard manual rate for the involved trade, as set by the Worker's Compensation Rating and Inspection

Bureau of Massachusetts. This rate shall not include any surcharges such as experience modifications and all risk factor adjustment programs, etc.

- f. For work performed by the Contractor's own forces, there shall be added an amount of 15% of items **a - d** for overhead, superintendence, and profit.
- g. For work performed by any Subcontractor, there shall be added an amount of 15% of the Subcontractor's costs for Items **a - d** for the Subcontractor's overhead, superintendence and profit. The Contractor shall be entitled to an additional 10% mark-up on the total amount of the Subcontractor's price as compensation for assuming full responsibility and supervision for the Subcontractor's work.
- h. Actual increases in the premium costs for performance and payment bonds required of the Contractor and filed Subcontractors, provided there will be an appropriate credit for reduced premiums for a credit change order.
- i. On any change in the Contract Sum that involves a credit, the amount of the credit will not include an overhead and profit factor, however, the credit will include an amount for item **d**, which shall not be less than 25% of item **a**.

8.3.2 The method provided in Subparagraph 8.3.1, for compensating the Contractor and Subcontractors for changes in the Work, shall be considered to adequately compensate the Contractor and Subcontractors for any and all costs directly, indirectly, or consequentially related to, or caused by, such change in the work.

8.4 WORK PERFORMED UNDER PROTEST

The Contractor shall perform all work as directed by the Prime Designer, and if the Prime Designer determines that certain work for which the Contractor has requested a change order does not represent a change in the Contract, or if the Contractor and the Prime Designer cannot agree to the amount of compensation for a change order, the Contractor shall perform said work under protest and must follow the notice requirements and maintain the records required by Subparagraph 8.7.3.

8.5 STATUTORY CHANGE ORDER PROVISIONS

The Contractor's attention is directed to the Massachusetts General Laws Chapter 30, §§ 39I, 39J, 39N, 39O and 39P, the provisions of which apply to this Contract.

8.6 DIFFERING SITE CONDITIONS, M.G.L. c.30 §39N

8.6.1 If, during the progress of the Work, the Contractor or the Owner discovers that the actual subsurface or latent physical conditions encountered at the site differ substantially or materially from those shown on the plans or indicated in the Contract Documents, either the Contractor or the Owner may request an appropriate time extension and an equitable adjustment in the Contract Sum applying to work affected by the differing site conditions. A request for such an adjustment shall be in writing and shall be delivered by the party making such claim to the other party as soon as possible after such conditions are discovered.

8.6.2 Upon receipt of such a claim from a Contractor, or upon its own initiative, the Owner shall make an investigation of such physical conditions, and, if they differ substantially or materially from those shown on the plans or indicated in the Contract Documents or from those ordinarily encountered and generally recognized as inherent in work of the character provided for in the plans and Contract Documents and are of such nature as to cause an increase or decrease in the cost of performance of the work or a change in the construction methods required for the performance of the work which results in an increase or decrease in the cost of the work, the Owner shall upon submission by the Contractor of a properly submitted Change Order request, make an equitable adjustment in the Contract Sum and the Contract shall be modified in writing accordingly.

8.6.3 TIMELY DECISION BY OWNER. M.G.L. c.30 §39P

Whenever this Contract requires the Owner or its Prime Designer to make a decision during construction of the Project, on interpretation of the specifications, approval of equipment, material or any other approval, or progress of the work, that decision shall be made promptly and, in any event, no later than thirty days after receipt of a written submission for such decision by the Contractor; but if such decision

requires extended investigation and study, the Owner or the Prime Designer shall, within thirty (30) days after the receipt of the submission, give the Contractor written notice of the reasons why the decision cannot be made within the thirty day period and the date by which the decision will be made.

8.7 CLAIMS

8.7.1 If the Contractor has any claim or dispute of any nature arising under this Contract, including a claim based on the Owner's failure or refusal to approve a change order request of the Contractor, in full or in part, the Contractor shall submit such claim or dispute to the Prime Designer, in the form of a change order request, for initial review and consideration, subject to further appeal to the Administrator. If the Contractor is not satisfied with the Prime Designer's decision or, if the Prime Designer fails to render a decision within thirty (30) days after receiving written notice of such claim or dispute from the Contractor, the Contractor may file a written request for a decision with the Department pursuant to Subparagraph 8.7.2.

8.7.2 Appeal of an Prime Designer's decision under Subparagraph 8.7.1 must be made directly to the Administrator by certified mail, copy to the Prime Designer and Owner, within twenty-one (21) calendar days after the date on which the party making the appeal receives the Prime Designer's written decision or within twenty-one (21) days after the thirty (30) day non-decision period noted in 8.7.1. Failure to appeal within this period will result in the Prime Designer's decision becoming final and binding upon the Owner and the Contractor.

8.7.3 Pending resolution of the claim or dispute, the Contractor must proceed with the disputed Work, as directed by the Prime Designer. The Contractor must give written notice to the Department and the Prime Designer stating that it is proceeding with the disputed work under protest. Accurate records of the nature and extent of the disputed Work and of the time spent and equipment used on the disputed Work shall be maintained by the superintendent and verified daily by the Project Representative or the Owner's designee. Failure of the Contractor to maintain such records shall cause the Contractor to forfeit its claim to additional compensation for such disputed work.

ARTICLE 9 TIME, SCHEDULES, AND COMPLETION

9.1 DEFINITIONS

9.1.1 Unless otherwise provided, Contract Time is the period of time, as extended by approved Change Order, allotted in the Contract Documents for Substantial Completion of the Work.

9.1.2 The date of commencement of the Work is the date established in the Notice to Proceed from the Owner. The commencement date shall not be postponed by the failure to act by the Contractor or by persons or entities for whom the Contractor is responsible.

9.1.3 The date of Substantial Completion is the date certified by the Prime Designer in accordance with Subparagraph 9.6.7.

9.1.4 The term "day" as used in the Contract Documents shall mean calendar day unless otherwise specifically defined.

9.2. PROGRESS AND COMPLETION

9.2.1 Time limits stated in the Contract Documents are of the essence of the Contract. By executing the Contract the Contractor confirms that the Contract Time is a reasonable period for performing the Work.

9.2.2 The Contractor shall proceed expeditiously with adequate forces and shall achieve Completion within the Contract Time.

9.3 DELAYS AND EXTENSIONS OF TIME

9.3.1 The Contractor shall be entitled to an extension of time for completion of the Work because of;

- .1 acts of God;
- .2 labor disputes;
- .3 abnormal weather conditions; or
- .4 acts of neglect of the Owner, Prime Designer, or Department as described in Subparagraph 8.6.3.

9.3.1.5 Except in unusual circumstances, delays caused by suppliers, Subcontractors and sub-subcontractors shall be considered to be within the control of the Contractor.

9.3.1.6 Should the Contractor require additional time to complete the Work, the Contractor shall document the reasons therefore and request an extension of time at the time the alleged delay occurs, as provided in this Article and Article 8.

9.3.1.7 Failure to notify the Prime Designer of any delay as provided in this Article shall preclude the Contractor from subsequently claiming any damages due to said delay.

9.3.1.8 Requests for extensions of time shall be submitted as a change order request to the Prime Designer under Article 8 for the Owner's consideration.

9.3.2 CONTRACTOR'S LIABILITY FOR DELAYS

The Contractor shall be liable for, and shall pay, to the Owner, all of the Owner's Project related costs incurred after the time stipulated for Substantial Completion, as extended by Change Order. Such costs shall include: fees paid to the Prime Designer as extra services for inspection services and administration of the Contract, at the rate stipulated in the Contract for Architectural/Engineering Services between the Owner and the Prime Designer; the costs of the Project Representative at the current salary rate; lost rental income based on the average rent collected by the Owner, and/or increased rental subsidies and any other direct expenses. The Owner may retain from moneys otherwise due the Contractor whatever sums accrue to the Owner pursuant to this provision. The Contractor shall not be liable for costs for delay in performance for any period for which an extension of the Contract Time has been granted pursuant to the provisions of Subparagraph 9.3.

9.3.3 OWNER DELAYS

9.3.3.1 The Owner may delay the commencement of the Work, or any part thereof, due to unforeseen circumstances or conditions which have a bearing on the Work required under this Contract or for any other reason if it is deemed to be in the best interest of the Owner to do so. Except as expressly provided in the following Subparagraphs 9.3.3.2, 9.3.3.3, and 9.3.3.4, the Contractor shall have no claim for additional compensation on account of such delay, but shall be entitled to an extension of Contract Time as determined reasonable by the Prime Designer.

9.3.3.2 The Contractor and the Owner agree that the following Subparagraphs provide the Contractor with the right to request additional compensation for Owner caused delays only in the following two circumstances:

- .1 When the Owner provides the Contractor with a written order to suspend or delay the Work, or a portion thereof, for a period of fifteen days or more.
- .2 When the Owner or its Prime Designer fails to make a decision within the thirty day period described in Subparagraph 8.6.3 and such failure delays the Work, or a portion thereof, for fifteen days or more.

9.3.3.3 The Owner may, for its convenience, order the Contractor in writing to suspend, delay, or interrupt all or any part of the Work for such period of time as it may determine appropriate, provided however, that if there is a suspension, delay, or interruption for fifteen (15) days or more, or there is a failure of the Owner to act within the time specified in this Contract, the Owner shall make an adjustment in the Contract Sum for any increase in the cost of performance of this Contract, but shall not include any profit to the Contractor on account of such increase; and provided further, that the Owner shall not make any adjustment in the Contract Sum under this provision for any suspension, delay, interruption, or failure to act to the extent that such is due to any cause for which this Contract provides for an equitable adjustment of the Contract Sum under any other Contract provisions. M.G.L. c.30 §390 (a).

9.3.3.4 The Contractor must submit the amount of a claim under Subparagraph 9.3.3.3 to the Owner in writing as soon as practicable after the end of the suspension, delay, interruption, or failure to act and, in any event, not later than the date of final payment under this Contract and except for costs due to a suspension order, the Owner shall not approve any costs in the claim incurred more than twenty days before the Contractor notified the Owner in writing of the act or failure to act involved in the claim. M.G.L. c.30 §390 (b).

9.3.3.5 The Owner and the Contractor agree that the preceding Subparagraph 9.3.3.4 places a burden on the Contractor to inform the Owner, whenever the Contractor considers that an action or inaction of the Owner or its Prime Designer could result or has resulted in a delay in the Project, thereby providing the Owner with the opportunity to take action to avoid or lessen the time extensions or damages that might be associated with such action or inaction.

9.3.3.6 The Contractor must file any claim for additional compensation made pursuant to Subparagraph 9.3.3.4 as a Change Order request. The amount of any such claim shall be calculated only in accordance with the provisions of Subparagraph 8.3.1.3 items a through i, and shall be subject to the provisions of Subparagraph 8.3.2.

9.4 CONSTRUCTION AND PAYMENT SCHEDULES

9.4.1 Prior to commencement of the Work the Contractor shall submit to the Prime Designer a construction schedule in bar graph form, satisfactory to the Prime Designer, showing in detail the proposed progress for the construction of the various parts of the Work, the proposed times for receiving materials required, and the interrelationship between the various construction operations and the percentage of completion and the dollar value of the completed work on the first day of each month for each section of the specifications and the entire Work. Submission of said schedule shall be a condition precedent to approval of the Contractor's first application for payment.

9.4.2 At the end of each month, or more often if required, the Contractor shall furnish the Prime Designer an updated schedule showing actual progress of the various parts of the Work in comparison with the originally proposed progress and payment schedules. If the Prime Designer raises any objections to progress or payment schedules submitted by the Contractor, the Contractor shall immediately address and resolve such objections to the reasonable satisfaction of the Prime Designer.

9.4.3 If the Contractor submits a construction schedule that anticipates Substantial Completion before the date established in the Owner's Notice to Proceed, the Contractor shall have no claim for additional compensation on account of any delays that prevent Substantial Completion before the date set in said Owner's Notice to Proceed.

9.5 USE AND OCCUPANCY

9.5.1 Prior to the date of Substantial Completion of the entire Project stipulated in the Notice to Proceed, the Owner shall have the right, from time to time, to occupy and use any portion of the Project as the Work in connection therewith is substantially completed, provided such use and occupancy does not unduly interfere with the Contractor's operations.

9.5.2 The Prime Designer will, prior to any such use and occupancy, give written notice to the Contractor, indicating the areas intended to be occupied and used, and the intended commencement date of such

use and occupancy. Occupancy and use shall not commence prior to a time mutually agreed to by the Owner and the Contractor.

9.5.3 Upon receipt of such notice of intent, the Contractor shall promptly secure and submit to the Prime Designer endorsement from the insurance carrier permitting use and occupancy of the Work, or any designated portion thereof, by the Owner prior to Substantial Completion of the entire Project. The Contractor shall be permitted to cancel its special perils insurance for that portion of the Project used and/or occupied by the Owner.

9.5.4 Partial or entire use and occupancy by the Owner shall not constitute an acceptance of Work not completed in accordance with the Contract Documents nor relieve the Contractor from the obligation of performing any Work required by the Contract but not completed at the time of use and occupancy. Before such use and occupancy, the Prime Designer will give the Contractor a list of items to be completed prior to Final Completion occurring in the areas to be occupied.

9.5.5 The Contractor shall be relieved of all maintenance costs of the portion of the Project occupied under the provisions of this Article.

9.5.6 The Contractor shall not be responsible for wear and tear or damage resulting solely from such use and occupancy.

9.5.7 The Contract Sum will be adjusted by mutually acceptable arrangements between the Owner and the Contractor with respect to heat, electricity, and water furnished by the Contractor to the portion of the Work so occupied.

9.5.8 When any portion of the building is in condition to receive fittings, appliances, furniture, or other property to be furnished and installed by the Owner under separate contracts, the Contractor shall allow the Owner to bring such items into the building and shall provide all reasonable facilities and protection therefore.

9.6 SUBSTANTIAL COMPLETION

9.6.1 Substantial Completion is the stage in the progress of the Work when, in the opinion of the Prime Designer, the Work is sufficiently complete in accordance with the Contract Documents so the Owner can occupy or utilize the Work for its intended use.

9.6.2 When the Contractor considers that the Work, or a portion thereof which the Owner agrees to accept separately, is substantially complete, the Contractor shall prepare and submit to the Prime Designer a comprehensive list of items to be completed or corrected. The Contractor shall proceed promptly to complete and correct items on the list. Failure to include an item on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents.

9.6.3 Upon receipt of the Contractor's list of items to be completed or corrected, the Prime Designer will promptly make a thorough inspection and prepare a "punch list", setting forth in accurate detail any items on the Contractor's list and additional items that are not acceptable or are incomplete.

9.6.4 If, after receipt of the Contractor's list, the Prime Designer determines that the Work is not substantially complete, the Prime Designer shall inform the Contractor of those items that must be completed before the Prime Designer will prepare a punch list. Upon completion of those items, the Contractor shall again request the Prime Designer to prepare the punch list.

9.6.5 When the punch list has been prepared, the Contractor will arrange a meeting with the Prime Designer and Subcontractors to identify and explain all punch list items and address questions on the work which must be done before final acceptance.

9.6.6 The Prime Designer may revise the punch list, from time to time, to ensure that all items of the Work are properly completed.

9.6.7 The Prime Designer will prepare a Certificate of Substantial Completion which shall establish the date of Substantial Completion, shall establish responsibilities of the Owner and Contractor for security, maintenance, heat, utilities, damage to the Work and insurance, and shall fix the time within which the Contractor shall finish all items on the list accompanying the Certificate within the provisions of Subparagraph 9.7.2.

9.6.8 Warranties required by the Contract Documents shall commence on the date of Substantial Completion of the Work or designated portion thereof unless otherwise provided in the Certificate of Substantial Completion. The Certificate of Substantial Completion shall be submitted to the Owner and Contractor for their written acceptance of responsibilities assigned to them in such Certificate and shall be subject to the approval of the Department.

9.7 FINAL COMPLETION

9.7.1 After the Prime Designer has certified that the Work is substantially complete, the Contractor shall immediately proceed to complete all the remaining items of Work as determined by the Prime Designer, including items authorized by Change Orders, Construction Change Directives, or items disputed by the Contractor.

9.7.2 The Contractor shall complete all the remaining items of Work described in Subparagraph 9.7.1, as soon as possible, and in any event within one hundred and twenty days after Substantial Completion, unless the Prime Designer determines that a shorter time period for completion is appropriate, in which event the Contractor must complete the Contract work within such period. The Prime Designer may extend such one hundred and twenty day period if the Prime Designer determines that such extension is justified.

9.7.3 If the Contractor fails to complete the remaining items of Work within the time period provided in Subparagraph 9.7.2, the Owner may arrange for other contractors to complete such items and the direct and indirect costs of such completion shall be charged against the balance due the Contractor or, if no such balance remains, the Contractor shall pay the Owner the costs of such completion.

9.7.4 As an alternative to the procedure described in Subparagraph 9.7.3, the Owner may invoke the performance bond of the Contractor and demand that the surety shall complete the remaining items of work in a timely manner.

9.7.5 The Prime Designer will conduct up to three (3) inspections of completed punchlist items. The Contractor shall be responsible for the costs of additional inspections required to verify successful completion of the punchlist.

ARTICLE 10 PAYMENTS

10.1 CONTRACT SUM

The Contract Sum is stated in the Owner-Contractor Agreement and, including authorized adjustments, is the total amount payable by the Owner to the Contractor for performance of the Work under the Contract Documents.

10.2 SCHEDULE OF VALUES

10.2.1 Before the first Application for Payment, the Contractor shall submit to the Prime Designer a schedule of values allocated to various portions of the Work, prepared in such form and supported by such data to substantiate its accuracy as the Prime Designer may require. This schedule, unless objected to by the Prime Designer, shall be used as a basis for reviewing the Contractor's Applications for Payment.

10.2.2 The schedule of values shall contain a separate item for each Section of the Specifications broken down in such form as the Prime Designer may require. Each item in the schedule of values shall include its proper share of overhead and profit.

10.3 APPLICATIONS FOR PAYMENT

Once each month, on a date established at the beginning of the Work, the Contractor shall deliver to the Prime Designer by hand or by registered or certified mail with return receipt, an itemized Application for Payment, supported by such data substantiating the Contractor's right to payment as the Prime Designer may require, and reflecting retainage as provided in Subparagraph 10.6.1. Such Application for Payment shall be submitted on a form available from the Department, (a copy can be found in the Construction Handbook). The form shall show separately:

- .1 The value of labor and materials incorporated in the Work.
- .2 The value, kind, and quantity of each item of material or equipment not incorporated in the Work but delivered and suitably stored at the site, during the current pay period.
- .3 The value, kind, and quantity of each item of material or equipment not incorporated in the Work but suitably stored at some other location agreed upon in writing, during the current pay period.
- .4 All Change Orders approved up to the date of the Application for Payment.
- .5 The amounts approved for payment for each item on previous applications.

10.4 PAYMENT FOR STORED MATERIALS

10.4.1 The Contractor shall include in such Application for Payment only such materials as are incorporated in the Work. Except however, the Contractor may include the value of materials or equipment delivered at the site of the Work (or at some location agreed to in writing) upon delivery to the Owner of:

- .1 an acceptable Transfer of Title (see the Construction Handbook); and
- .2 receipted invoices or other acceptable proof of prior payment by the Contractor for such materials; and
- .3 a stored materials insurance binder (see subparagraph 16.5.2) that covers the materials for which payment is requested, that names the Owner and the Department as an insured party should the stored materials be subjected to any casualty, loss, or theft prior to their inclusion in the Work.

10.4.2 This material(s) or equipment must, in the judgment of the Prime Designer:

- .1 meet the requirements of the Contract, including prior shop drawing, product data, and sample approval; and
- .2 be ready for use; and
- .3 be properly stored by the Contractor and adequately protected until incorporated into the Work.

10.4.3 Failure to comply with subparagraphs 10.4.1 and 10.4.2 may result in Certificates being changed in accordance with M.G.L. c.30 §39K.

10.5. CERTIFICATES FOR PAYMENT

10.5.1 The Prime Designer shall mark the date of receipt on the Contractor's Application for Payment. The Prime Designer will, within seven days after receipt of the Contractor's Application for Payment either,

- .1 issue to the Owner a Certificate for Payment, with a copy to the Contractor, for such amount as the Prime Designer determines is properly due, or
- .2 return the application to the Contractor if it is not in proper form or contains computations not arithmetically correct; or
- .3 make changes to the application as provided in subparagraph 10.5.2.

10.5.2 The Prime Designer shall notify the Contractor and Owner in writing of the Prime Designer's reasons for withholding certification in whole or in part as provided in subparagraphs 10.6.1.2 and 10.6.1.3.

10.5.3 The Owner may make changes in any Application for Payment submitted by the Contractor in accordance with M.G.L. c.30 §39K, and the payment due on said Application for Payment shall be

computed in accordance with the changes so made. The provisions of said Section 39K shall govern payments pursuant to Applications for Payment on which the Owner has made changes.

10.5.4 No certificate for payment nor any progress payment shall constitute acceptance of Work not in accordance with the Contract Documents.

10.6 STATUTORY PAYMENT PROVISIONS

10.6.1 After the Prime Designer has issued a Certificate for Payment the Owner shall make payment to the Contractor in accordance with M.G.L. c.30 §39K which provides as follows:

- .1 Within thirty 30 days after receipt from the Contractor, at the place designated by the Owner if such a place is so designated, of a periodic estimate requesting payment of the amount due for the preceding month, the Owner will make a periodic payment to the Contractor for the Work performed during the preceding month and for the materials not incorporated in the Work but delivered and suitably stored at the site (or at some location agreed upon in writing) to which the Contractor has title or to which a Subcontractor has title and has authorized the Contractor to transfer title to the Owner, less (1) a retention based on its estimate of the fair value of its claims against the Contractor and less (2) a retention for direct payments to Subcontractors based on demands for same in accordance with the provisions of Section 39F, and less (3) a retention not exceeding five percent (5%) of the approved amount of the periodic payment.
- .2 After the receipt of a periodic estimate requesting final payment and within 65 days after (a) the Contractor fully completes the Work or substantially completes the work so that the value of the Work remaining to be done is, in the estimate of the Owner, less than one percent (1%) of the original Contract Sum, or (b) the Contractor substantially completes the Work and the Owner takes possession for occupancy, whichever occurs first, the Owner shall pay the Contractor the entire balance due on the Contract less, (1) a retention based on its estimate of the fair value of its claims against the Contractor and of the cost of completing the incomplete and unsatisfactory items of Work less (2) a retention for direct payments to Subcontractors based on demands for same in accordance with the provisions of Section 39F, or based on the record of payments by the Contractor to the Subcontractors under this Contract if such record of payment indicates that the Contractor has not paid Subcontractors as provided in Section 39F.
- .3 If the Owner fails to make payment as herein provided, there shall be added to each such payment daily interest at the rate of three percentage points above the rediscount rate then charged by the Federal Reserve Bank of Boston commencing on the first day after said payment is due and continuing until the payment is delivered or mailed to the Contractor; provided, that no interest shall be due, in any event, on the amount due on a periodic estimate for final payment until thirty days after receipt of such a periodic estimate from the Contractor, at the place designated by the Owner if such a place is so designated. The Contractor agrees to pay to each Subcontractor a portion of any such interest paid in accordance with the amount due each Subcontractor.

10.6.2 DIRECT PAYMENT TO SUBCONTRACTORS

10.6.2.1 The Contractor shall make payments to filed Subcontractors in accordance with M.G.L c.30 §39F which provides as follows:

- .1 Forthwith after the Contractor receives payment on account of a periodic estimate, the Contractor shall pay to each Subcontractor the amount paid for the labor performed and the materials furnished by the Subcontractor, less any amount specified in any court proceedings barring such payment and also less any amount claimed due from the Subcontractor by the Contractor.
- .2 Not later than the 65th day after each Subcontractor substantially completes the Work in accordance with the plans and specifications, the entire balance due under the subcontract less amounts retained by the Owner as the estimated cost of completing the incomplete and unsatisfactory items of Work, shall be due the Subcontractor and the Owner shall pay that amount to the Contractor. The Contractor shall forthwith pay to the Subcontractor the full amount received from the Owner less any amount specified in any court proceedings barring such payment and also less any amount claimed due from the Subcontractor by the Contractor.
- .3 Each payment made by the Owner to the Contractor pursuant to Subparagraphs .1 and .2 of this paragraph for the labor performed and the materials furnished by a Subcontractor shall be made to the Contractor for the account of that Subcontractor and the Owner shall take reasonable steps to

compel the Contractor to make each such payment to each such Subcontractor. If the Owner has received a demand for direct payment from a Subcontractor for any amount which has already been included in a payment to the Contractor or which is to be included in a payment to the Contractor for payment to the Subcontractor as provided in Subparagraphs .1 and .2, the Owner shall act upon the demand as provided in this section.

- .4 If, within 70 days after the Subcontractor has substantially completed the Subcontract Work, the Subcontractor has not received from the Contractor the balance due under the Subcontract including any amount due for extra labor and materials furnished to the Contractor, less any amount retained by the Owner as the estimated cost of completing the incomplete and unsatisfactory items of Work, the Subcontractor may demand direct payment of that balance from the Owner. The demand shall be by a sworn statement delivered to or sent by certified mail to the Owner, and a copy shall be valid even if delivered or mailed prior to the seventieth day after the Subcontractor has substantially completed the Subcontract Work. Within ten days after the Subcontractor has delivered or so mailed a copy to the Contractor, the Contractor may reply to the demand. The reply shall be by a sworn statement delivered to or sent by certified mail to the Owner, and a copy shall be delivered to or sent by certified mail to the Subcontractor at the same time. The reply shall contain a detailed breakdown of the balance due under the Subcontract including any amount due for extra labor and materials furnished to the Contractor and of the amount due for each claim made by the Contractor and of the amount due for each claim made by the Contractor against the Subcontractor.
- .5 Within 15 days after receipt of the demand by the Owner but in no event prior to the 70th day after substantial completion of the Subcontract Work, the Owner shall make direct payment to the Subcontractor of the balance due under the Subcontract including any amount due for extra labor and materials furnished to the Contractor, less any amount (i) retained by the Owner as the estimated cost of completing the incomplete or unsatisfactory items of Work, (ii) specified in any court proceedings barring such payment, or (iii) disputed by the Contractor in the sworn reply; provided, that the Owner shall not deduct from a direct payment any amount as provided in part (iii) if the reply is not sworn to, or for which the sworn reply does not contain the detailed breakdown required by Subparagraph .4. The Owner shall make further direct payments to the Subcontractor forthwith after the removal of the basis for deductions from direct payments made as provided in part (i) and (ii) of this Subparagraph.
- .6 The Owner shall forthwith deposit the amount deducted from a direct payment as provided in part (iii) of Subparagraph .5 in an interest-bearing joint account in the names of the Contractor and the Subcontractor in a bank in Massachusetts selected by the Owner or agreed upon by the Contractor and the Subcontractor and shall notify the Contractor and the Subcontractor of the date of the deposit and the bank receiving the deposit. The bank shall pay the amount in the account, including accrued interest, as provided in an agreement between the Contractor and the Subcontractor or as determined by decree of a court of competent jurisdiction.
- .7 All direct payments and all deductions from demands for direct payments deposited in an interest-bearing account or accounts in a bank pursuant to Subparagraph .6 shall be made out of amounts payable to the General Contractor at the time of receipt of a demand for direct payment from a Subcontractor or out of amounts which later become payable to the Contractor and in order of receipt of such demands from Subcontractors. All direct payments shall discharge the obligation of the Owner to the Contractor to the extent of such payment.
- .8 The Owner shall deduct from payments to the Contractor amounts which, together with the deposits in interest-bearing accounts pursuant to Subparagraph .6, are sufficient to satisfy all unpaid balances of demands for direct payment received from Subcontractors. All such amounts shall be earmarked for such direct payments, and the Subcontractors shall have a right to such deductions prior to any claims against such amounts by creditors of the Contractor.
- .9 If the Subcontractor does not receive payment as provided in Subparagraph .1 or if the Contractor does not submit a periodic estimate for the value of the labor and materials performed or furnished by the Subcontractor and the Subcontractor does not receive payment for same when due less the deductions provided for in Subparagraph .1, the Subcontractor may demand direct payment by following the procedure in Subparagraph .4 and the Contractor may file a sworn reply as provided in that same Subparagraph. A demand made after the first day of the month following that for which the Subcontractor performed or furnished the labor and materials for which the Subcontractor

seeks payment shall be valid even if delivered or mailed prior to the time payment was due on a periodic estimate from the Contractor. Thereafter the Owner shall proceed as provided in Subparagraphs .5, .6, .7, and .8.

10.7 FINAL PAYMENT

10.7.1 Upon completion of the Work, the Contractor shall be entitled to payment of the Contract balance, in accordance with Subparagraph 10.6.1.2 and per the process described in Division 1 of the Specifications.

10.7.2 The acceptance by the Contractor of the last payment due under this Contract or the execution of the Final Certificate of Completion, shall operate as a release to the Owner, Department and the Prime Designer from all claims and liability related to this Contract.

10.8 PAYMENT LIABILITIES OF CONTRACTOR

10.8.1 The Contractor shall be responsible to the Owner for all expenses, losses, and damages incurred in consequence of any defect, omission, or mistake of the Contractor or any of its employees, Subcontractors, or suppliers.

10.8.2 The Owner may retain any moneys which would otherwise be payable under this Contract and apply the same, or so much as may be necessary therefore, to the payment of any expenses, losses, or damages incurred by the Owner as a direct result of the Contractor's failure to perform its obligations hereunder.

ARTICLE 11 GUARANTEES AND WARRANTIES

11.1 GENERAL GUARANTY

If at any time during the period of one (1) year from the date of Substantial Completion as defined in Paragraph 9.6, any part of the Work shall, in the reasonable determination of the Prime Designer or Owner, require replacing or repairing due to the fact that it is broken, defective, or otherwise does not conform to the Contract Documents, the Owner will notify the Contractor to make the required repairs or replacement.

11.2 If the Contractor shall neglect to commence such repairs or replacement to the satisfaction of the Owner within ten (10) days from the date of giving or mailing such notice, then the Owner may employ other persons to make the same.

11.3 The Contractor agrees, upon demand, to pay to the Owner all amounts which the Owner expends for such repairs or replacements.

11.4 During this one year guarantee period any corrective work shall be performed in accordance with the applicable terms of this Contract. For items of work completed after use and occupancy has been taken, the one year guarantee shall commence at the time the Owner accepts such items.

11.5 This one year guarantee shall not limit any express guaranty or warranty provided elsewhere in the Contract.

11.2 SPECIAL GUARANTEES AND WARRANTIES

11.2.1 Guarantees and warranties required in the various sections of the Specifications must be delivered to the Prime Designer before final payment to the Contractor may be made, or in the case of guarantees and warranties which originate with a Subcontractor's section of the Work, before final payment for the amount of that subtrade or for the phase of Work to which the guarantee or warranty relates.

11.2.2 The failure to deliver a required guarantee or warranty shall constitute a failure to fully complete the Work in accordance with the Contract Documents.

11.2.3 The Contractor's obligation to correct Work as set forth in Paragraph 4.12 is in addition to, and not in substitution of, such guarantees or warranties as may be required in the various Sections of the Specifications.

ARTICLE 12 MISCELLANEOUS LEGAL REQUIREMENTS

12.1 GENERAL

The Contractor shall stay fully informed of all existing and future state and national laws and municipal ordinances and regulations in any manner affecting those engaged or employed in the work, or the materials used or employed in the work, or in any way affecting the conduct of the Work, and of all such orders and decrees of bodies or tribunals having any jurisdiction or authority over the Contract Work. All provisions of law that apply to this Contract are hereby made a part of this Contract. If any discrepancy or inconsistency is discovered in the Contract Documents in relation to any such law, ordinance, regulation, order or decree, the Contractor shall forthwith report the same to the Owner in writing.

12.1.1 The Contractor shall cause all of its agents and employees to observe and comply with all such existing and future laws, ordinances, regulations, orders and decrees.

12.2 CORPORATE DISCLOSURES

The Contractor, if a foreign corporation, shall comply with M.G.L. c.181 §3 and §5, and M.G.L. c.30 §39L.

12.3 VETERANS PREFERENCE

In the employment of mechanics and apprentices, teamsters, chauffeurs, and laborers in the construction of public works in the Commonwealth, preference shall first be given to citizens of the Commonwealth who have been residents of the Commonwealth for at least six months at the commencement of their employment and who are veterans as defined M.G.L. c.4 §7 (34), and who are qualified to perform the work to which the employment relates; and secondly, to citizens of the Commonwealth generally who have been residents of the Commonwealth for at least six months at the commencement of their employment, and if they cannot be obtained in sufficient numbers, then to citizens of the United States

12.4 PREVAILING WAGE RATES

The Commissioner of the Department of Labor, Division of Occupational Safety has established the Schedule found in Division One of the Specifications, listing the prevailing minimum wage rates that must be paid to all workers employed on the Contract. Such Schedule shall continue to be the minimum rate of wages payable to workers on this Contract throughout the term of the Contract. The Contractor shall not have any claim for extra compensation from the Owner if the actual wages paid to employees on the Contract exceeds the rates listed on the Schedule. The Contractor shall cause a copy of said Schedule to be kept in a conspicuous place at the Project site during the term of the Contract. (See M.G.L. c.149 §26-27H.) If reserve police officers are employed by the Contractor, they shall be paid the prevailing wage of regular police officers. (See M.G.L. c.149 §34B).

12.5 VEHICLE AND EQUIPMENT OPERATORS

If the Commissioner of the Department of Labor, Division of Occupational Safety has established a Schedule of wage rates to be paid to the operators of trucks, vehicles or equipment for this Project, the Contractor shall be obligated to pay such operators at least the minimum wage rate contained on such Schedule. (See M.G.L. c.149 §26-27H).

12.6 EIGHT HOUR DAY AND LODGING

12.6.1 No laborer, workman, mechanic, foreman or inspector working in the employment of the Contractor, Subcontractor or other person doing or contracting to do the whole or part of the Work, shall be required or permitted to work any more than eight hours in any one day, or more than 48 hours in any one week, or more than six days in any one week, except in cases of emergency.

12.6.2 Every employee on the Work shall lodge, board, and trade where and with whom he/she elects, and the Contractor and any Subcontractor shall not directly or indirectly require, as a condition of employment, that an employee lodge, board, or trade at a particular place or with a particular person.

12.7 EXECUTIVE ORDERS

The Contractor shall comply with the provisions of M.G.L. c.151B; Executive Order No. 524 Establishing the Massachusetts Supplier Diversity Program (SDP), Executive Order 526, Order regarding Non-Discrimination, Diversity, Equal Opportunity, and Affirmative Action; pertaining to minority and women owned business enterprises; Executive Order 527 establishing the Office of Access and Opportunity and Executive Order 481, prohibiting the use of undocumented workers on state contracts and all regulations promulgated pursuant thereto. The aforementioned law, executive orders, regulations and any amendments are incorporated herein by reference and made a part of this Contract.

12.8 CONFLICT OF INTEREST:

The Contractor covenants, that (1) presently, there is no financial interest and shall not acquire any such interest, direct or indirect, which would conflict in any manner or degree with the performance of services required to be performed under this Agreement or which would violate M.G.L. c.268A, as amended; (2) in the performance of this Contract, no person having any such interest shall be employed by the Contractor or engaged as a subcontractor by the contractor; and (3) no partner or employee of the firm is related by blood or marriage to any Board Member or employee of the Awarding Authority.

12.9 LEAD BASED PAINT NOTIFICATION

The Contractor shall comply with EPA 40 CFR 745 Subpart E "Residential Property Renovation" for pre-1978 residential properties regarding Owner and Tenant notification using the Pre-Renovation Form for unit work and/or the Renovation Notice for Tenants in Common Areas of Multi-family Housing for common/exterior work and the distribution of the EPA pamphlet Renovate Right: Important Lead Hazard Information for Families, Child Care Providers and Schools prior to renovation activities where more than 2 square feet of painted surfaces per room are disturbed for interior activities or greater than 10 square feet of painted surfaces are disturbed for exterior activities. This applies to work areas that are known to contain lead-based paint (greater than or equal to 1.0 mg/cm² lead via XRF, a "positive" result using sodium sulfide or 0.5% lead via laboratory analysis) and to work areas that do not have data regarding the lead concentration in the paint.

ARTICLE 13 CONTRACTOR'S ACCOUNTING REQUIREMENTS

13.1 DEFINITIONS

13.1.1 "Contractor" means any person, corporation, partnership, joint venture, sole proprietorship, or other entity awarded this Contract.

13.1.2 "Contract" means any contract awarded or executed pursuant to M.G.L. c.30 §39M or M.G.L. c.149 §44A-J, which is for an amount greater than one hundred thousand dollars (\$100,000).

13.1.3 "Records" means books of original entry, accounts, checks, bank statements and all other banking documents, correspondence, memoranda, invoices, computer printouts, tapes, discs, papers and other documents or transcribed information of any type, whether expressed in ordinary or machine language.

13.1.4 "Independent Certified Public Accountant" means a person duly registered in good standing and entitled to practice as a certified public accountant under the laws of the place of his/her residence or principal office and who is in fact independent.

13.1.5 "Audit," when used in regard to financial statements, means an examination of records by an independent certified public accountant in accordance with generally accepted accounting principles and auditing standards for the purpose of expressing a certified opinion thereon, or, in the alternative, a qualified opinion or a declination to express an opinion for stated reasons.

13.1.6 "Accountant's Report," when used in regard to financial statements, means a document in which an independent certified public accountant indicates the scope of the audit which he/she has made and sets forth his/her opinion regarding the financial statements taken as a whole with a listing of noted exceptions and qualifications, or an assertion to the effect that an overall opinion cannot be expressed. When an overall opinion cannot be expressed the reason therefore shall be stated. An accountant's report shall include a signed statement by the responsible corporate officer attesting that management has fully disclosed all material facts to the independent certified public accountant, and that the audited financial statement is a true and complete statement of the financial condition of the Contractor.

13.1.7 "Management," when used herein, means the chief executive officers, partners, principals or other person or persons primarily responsible for the financial and operational policies and practices of the Contractor.

13.1.8 Accounting terms, unless otherwise defined herein shall mean, in accordance with generally accepted accounting principles and auditing standards.

13.2 RECORD KEEPING

13.2.1 The Contractor shall make, and keep for at least six years after final payment, books, records, and accounts which in reasonable detail accurately and fairly reflect the transactions and dispositions of the Contractor.

13.2.2 Until the expiration of six years after final payment, the Inspector General, the Owner, and the Department shall have the right to examine any books, documents, papers or records of the Contractor and Subcontractors that directly pertain to, and involve transactions relating to the Contractor and Subcontractors.

13.2.3 The Contractor shall describe any change in the method of maintaining records or recording transactions which materially affects any statements filed with the Owner including the date of the change and reasons therefore, and shall accompany said description with a letter from the Contractor's independent certified public accountant approving or otherwise commenting on the changes.

13.2.4 Prior to the execution of the Contract, the Contractor shall file a statement of management on internal accounting controls as set forth in Paragraph 13.3 below.

13.2.5 Prior to the execution of the Contract, the Contractor shall file an audited financial statement for the most recent completed fiscal year as set forth in Paragraph 13.4 below and will continue to file such statement annually during the term of the Contract.

13.3 STATEMENT OF MANAGEMENT CONTROLS

13.3.1 Prior to execution of the Contract, the Contractor shall file with the Owner a statement of management as to whether the system of internal accounting controls of the Contractor and its subsidiaries reasonably assures that:

- .1 transactions are executed in accordance with management's general and specific authorization;
- .2 transactions are recorded as necessary to:
 - a. to permit preparation of financial statements in conformity with generally accepted accounting principles, and
 - b. to maintain accountability for assets;
- .3 access to assets is permitted only in accordance with management's general or specific authorization; and
- .4 the recorded accountability for assets is compared with the existing assets at reasonable intervals and appropriate action was taken with respect to any difference.

13.3.2 Prior to execution of the Contract, the Contractor shall also file with the Owner a statement prepared and signed by an independent certified public accountant, stating that the accountant has examined the statement of management on internal accounting controls, and expressing an opinion as to:

- .1 whether the representations of management in response to subparagraph 13.3.1 above are consistent with the results of management's evaluation of the system of internal accounting controls; and
- .2 whether such representations of management are reasonable with respect to transactions and assets in amounts which would be material when measured in relation to the applicant's financial statement.

13.4 ANNUAL FINANCIAL STATEMENT

Every Contractor awarded a contract shall annually file with the Owner during the term of the Contract a financial statement prepared by an independent certified public accountant on the basis of an audit by such accountant. The final statement filed shall include the date of final payment. All statements shall be accompanied by an accountant's report.

**ARTICLE 14
EQUAL EMPLOYMENT OPPORTUNITY REQUIREMENTS**

14.1 The Contractor shall not discriminate against any employee or applicant for employment because of race, color, religious creed, national origin, age, handicap, or sex. The aforesaid provision shall include, but not be limited to, the following employment upgrading, demotion or transfer; recruitment advertising; recruitment layoff; termination; rates of pay or other forms of compensation; conditions or privileges of employment; and selection for apprenticeship.

14.2 The Contractor must provide information as is necessary, in the judgment of the Owner or the Department, to ascertain compliance with the terms of Specification Section 00.73.36.

**ARTICLE 15
MINORITY OR WOMAN OWNED ENTERPRISES
SUPPLIER DIVERSITY PROGRAM**

15.1 COMPLIANCE

15.1 The Contractor must provide information as is necessary, in the judgment of the Owner and the Department, to ascertain compliance with the terms of Specification Section 00.73.39.

**ARTICLE 16
INSURANCE**

16.1 INSURANCE REQUIREMENTS

16.1.1 The Contractor shall take out and maintain insurance coverage as listed in subparagraphs 16.2 - 16.8 with respect to the operations as well as the completed operations of this Contract. This insurance shall be provided at the Contractor's expense and shall be in full force and effect for the full term of the Contract.

16.1.2 All policies shall be issued by companies authorized to write that type of insurance under the laws of this Commonwealth of Massachusetts.

16.2 CONTRACTOR'S COMMERCIAL GENERAL LIABILITY

16.2.1 Provide the following minimum coverage with respect to the operations performed by any employee, Subcontractor, or supplier:

Bodily Injury &	\$1,000,000. per occurrence
Property Damage	\$2,000,000. general aggregate
Products & Completed Operations	\$2,000,000. aggregate
Fire Damage	\$1,000,000.
Personal & Advertising Injury	\$1,000,000. per occurrence
Umbrella coverage	\$5,000,000 per occurrence

16.2.2 This policy shall include coverage relating to explosion, collapse, and underground property damage.

16.2.3 This policy shall include contractual liability coverage.

16.2.4 The Contractor shall provide a separate Owner's and Contractor's Protective Liability policy in the name of the Owner at the same limits listed above.

16.2.5 The completed operations coverage shall be maintained for a period of two (2) years after Substantial Completion as defined in subparagraph 9.6.1.

16.2.6 In addition to the coverage listed above the Remediation Contractor ("Abatement Contractor") shall provide evidence of specific coverage under its Commercial General Liability policy. This additional coverage shall be purchased and maintained by the Abatement Contractor. The policy shall:

- .1 be written on a "true" occurrence basis without any "sunset" clause;
- .2 have the pollution exclusion amended to add back coverage for all pollution claims.
- .3 include separate products and completed operations coverage, which shall be maintained for (2) years after Substantial Completion, as defined in subparagraph 9.6.1
- .4 provide the following limits of insurance:

Bodily Injury & Property Damage	\$1,000,000. per occurrence
Products & Completed Operations	\$2,000,000. general aggregate
Fire Damage	\$2,000,000. aggregate
Personal & Advertising Injury	\$1,000,000.
Umbrella coverage	\$1,000,000. per occurrence
	\$5,000,000 per occurrence

16.3 VEHICLE LIABILITY

Provide the following minimum coverage with respect to the operations of any employee, including coverage for owned, non-owned, and hired vehicles:

Bodily Injury and Property Damage	\$1,000,000. each person
	\$1,000,000. each accident
	Combined Single Limit of \$1,000,000

16.4 WORKER'S COMPENSATION

Provide the following coverage in accordance with M.G.L. c.149 §34A and c.152 as amended:

Worker's Compensation Coverage A	Provide Statutory Minimum
Employer's Liability Coverage B	\$500,000. each accident
	\$500,000. disease per employee
	\$500,000. disease policy

16.5 PROPERTY COVERAGE

16.5.1 Provide Builder's Risk (Special Perils) coverage against loss or damage by fire and against loss or damage covered by the special perils insurance endorsement on all work included in this contract in an amount equal to at least 80% of Contract Amount.

16.5.2 When work will be completed on existing buildings owned by the Owner, the Contractor shall provide an installation floater, in the full amount of the Contract, for the requirements set forth in Subparagraph 16.5.

16.5.3 This policy and/or installation floater shall indicate if Stored Materials coverage is provided as required by Paragraph 10.4.

16.6.1 The policy or policies shall specifically state that they are for the benefit of and payable to the Owner, the Department, the Contractor, and all persons furnishing labor or labor and materials for the Contract Work, as their interests may appear

16.6.2 The Builder's Risk (Special Perils) coverage shall include any costs for work performed by the Prime Designer or any consultant as the result of a loss experienced during the life of this contract.

16.7 OWNER AS ADDITIONAL INSURED

The Owner and Department shall be named as additional insured on the Contractor's Commercial Liability Policies.

16.8 CERTIFICATES OF INSURANCE, POLICIES

16.8.1 Certificates of insurance, acceptable to the Owner, shall be submitted to the Owner simultaneously with the execution of the Contract. Certificates shall indicate that the contractual liability coverage, and Owner's and Contractor's Protective Liability coverage is in force, as well as the deletions of the XCU exclusions.

16.8.2 The Contractor shall file the original and one certified copy of all policies with the Owner and one with the Department within sixty days after Contract award. If the Owner is damaged by the Contractor's failure to maintain such insurance and to so notify the Owner, then the Contractor shall be responsible for all reasonable costs attributable thereto.

16.9 CANCELLATION

Cancellation of any insurance required by this contract, whether by the insurer or the insured, shall not be valid unless written notice thereof is given by the party proposing cancellation to the other party and Owner at least ten(10) days prior to the effective date thereof, which shall be expressed in said notice

ARTICLE 17 INDEMNIFICATION

The Contractor shall take all responsibility for the Work and take all precautions for preventing injuries to persons and property in or about the Work; shall bear all losses resulting from or on account of the amount or character of the Work. The Contractor shall pay or cause payment to be made for all labor performed or furnished and for all materials used or employed in carrying out this Contract. The Contractor shall assume the defense of, and indemnify and save harmless, the Prime Designer, the Owner and their officers and agents from all claims relating to: labor performed or furnished and materials used or employed for the Work; inventions, patents and patent rights used in and in doing the Work unless such patent infringement is due to a product or process specified by the Owner; injuries to any person or corporation received or sustained by or from the Contractor and any employees, and Subcontractors and employees, in doing the work, or in consequence of any improper materials, implements or labor used or employed therein; and any act, omission, or neglect of the Contractor and any employees.

ARTICLE 18 PERFORMANCE AND PAYMENT BONDS

18.1 CONTRACTOR BONDS

18.1.1 The Contractor shall provide the Owner with performance and payment (labor and materials) bonds in the form provided by the Department, (Forms 00.61.13.13 and 00.61.13.16) executed by a surety licensed by the Commonwealth's Division of Insurance. Each such bond shall be in the amount of the Contract Sum.

18.1.2 If at any time prior to final payment to the Contractor, the Surety:

- .1 is adjudged bankrupt or has made a general assignment for the benefit of its creditors;
 - .2 has liquidated all assets and has made a general assignment for the benefit of its creditors;
 - .3 is placed in receivership;
 - .4 otherwise petitions a state or federal court for protection from its creditors; or
 - .5 allows its license to do business in Massachusetts to lapse or be revoked;
- the Contractor shall, within 21 days of any such action listed above, provide the Owner with new performance and payment bonds as described in Paragraph 18.1.1. Such bonds shall be provided solely at the Contractor's expense.

18.2 SUBCONTRACTOR BONDS

18.2.1 The Contractor may list in its bid that any or all filed Subcontractors provide the Contractor with payment and performance bonds for the full amount of the Subcontract. The costs for said bonds shall be the responsibility of the Contractor.

18.2.2 In the event the Contractor lists in its bid that filed Subcontractors provide bonds, and subsequently waives the requirement, the Contractor shall provide the Owner with a certification that they understand if the filed subcontractor defaults or is terminated, the Contractor accepts full responsibility and costs related to said default or termination with a credit change order in an amount equal to the bond premium it would have paid had it required the filed Subcontractor to provide such bonds.

ARTICLE 19 TERMINATION

19.1 TERMINATION FOR CAUSE

19.1.1 The Owner may terminate this contract for cause if it determines that any of the following circumstances have occurred:

- .1 The Contractor is adjudged bankrupt or has made a general assignment for the benefit of its creditors;
- .2 A receiver has been appointed of the Contractor's property;
- .3 All or a part of the Work has been abandoned;
- .4 The Contractor has sublet or assigned all or any portion of the Work, the Contract, or claims there under, without the prior written consent of the Owner, except as provided in the Contract;
- .5 The Prime Designer has determined that the rate of progress required on the project is not being met, or
- .6 The Contractor has substantially violated any provisions of this Contract.

19.1.2 In the event of such termination, the Owner may hold the Contractor and its sureties liable in damages as for a breach of contract, or the Owner may notify the Contractor to discontinue all work, or any part thereof, and the Contractor shall discontinue all work, or any part thereof, as the Owner may designate.

19.1.3 The Owner may complete the work, or any part thereof, and charge the expense of completing the Work or part thereof, to the Contractor.

19.1.4 The Owner may take possession of and use any materials, machinery, implements and tools found upon the site of said Work. The Owner shall not be liable for any depreciation, loss or damage to said materials, machinery, implements or tools during said use and the Contractor shall be solely responsible for their removal from the Project site after the Owner has no further use for them.

19.1.5 The Owner may, at its option, require the surety or sureties to complete the Contract.

19.2 TERMINATION LIABILITIES

19.2.1 All expenses charged under Paragraph 19.1 shall be deducted and paid by the Owner out of any moneys then due or to become due the Contractor under this Contract; and in such accounting the Owner shall not be held to obtain the lowest figures, by competitive bid or otherwise, for the completion of the Work or any part thereof.

19.2.2 All sums actually paid by the Owner to complete the Work shall be charged to the Contractor. In case the expenses charged are less than the sum which would have been payable under this Contract if the same had been completed by the Contractor, the Contractor shall be entitled to receive the difference. In case such expenses shall exceed the said sum, the Contractor shall pay the amount of the excess to the Owner.

19.2.3 Expenses incurred under subparagraph 19.1 shall also include, but not be limited to, costs for architectural/engineering extra services and Project Representative services required, in the opinion of the Owner, to successfully inspect and administer the construction contract through final completion, as described in Paragraph 9.7.

19.3 TERMINATION - NO FAULT

19.3.1 In the event that this Contract is terminated by the Owner, and termination is not based on a reason listed in Paragraph 19.1, the Contractor shall be compensated for its costs incurred on the Project, including reasonable costs of de-mobilization, calculated on a percent completion basis as provided in Article 10, covering the period of time between the last periodic payment and the date of termination.

19.3.2 Payment by the Owner pursuant to Subparagraph 19.3.1 shall be considered to fully compensate the Contractor for all claims and expenses and those of any consultants, Subcontractors, and suppliers, directly or indirectly attributable to the termination, including any claims for lost profits.

19.4 ADMINISTRATOR'S APPROVAL

Termination of the Contract requires the prior written approval of the Administrator.

END OF SECTION

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July 11, 2018

POPE'S TAVERN
ADDITION/RENOVATION
Halifax, Massachusetts

**SCHEDULE FOR PARTICIPATION
BY MINORITY/WOMEN BUSINESS ENTERPRISES
(SDO Exhibit A)**

Project Number: _____ Project Location: _____

Project Name: _____

- A. Filed Sub-bidders utilizing MBE/WBE firms, and MBE/WBE Sub-bidders - attach to Filed Sub-bid.
- B. General Contractor must submit to the Compliance Office within five (5) working days of the opening of General Bids.

BIDDER CERTIFICATION:

The Bidder agrees that if awarded the contract it will expend at least the amount of the contract set forth below for MBE/WBE participation. For purposes of this commitment, the MBE and WBE designation means that a business has been certified by Executive Director of the Supplier Diversity Office (SDO) as either a MBE, WBE or M/WBE, see Article XIII of the Contract. The Bidder must indicate the MBE/WBE firms it intends to utilize on the project as follows (attach additional sheets if necessary):

Company Name & Address	MBE or WBE	Describe MBE/WBE Scopes of Work (clarify "Labor Only", "Material Only" or "Labor and Material")	If Supplier, Indicate Total Value of Supplies (10% of total counts toward Participation)	Total Dollar Value of Participation
1.				
2.				
3.				
4.				
5.				
6.				
7.				
8.				

MBE Goal: \$ _____ Total Dollar Value of MBE Commitment \$ _____

WBE Goal: \$ _____ Total Dollar Value of WBE Commitment \$ _____

July 11, 2018

The undersigned hereby certifies that he/she has read the terms and conditions of the contract with regard to MBE/WBE participation and is authorized to bind the Bidder to the commitment set forth above.

Name of MBE/WBE Firm _____ Authorized Signature _____

Business Address _____ Print Name _____

_____ Title _____

Telephone No _____ Fax No _____ Date _____

End of Document

LETTER OF INTENT
MINORITY/WOMEN BUSINESS ENTERPRISES PARTICIPATION
(SDO Exhibit B)

(To be completed by MBE/WBE, and submitted by the General Bidder to the Owner's Project Manager within five (5) working days of the opening of General Bids or by Filed Sub-bidder with its bid.)

Indicate SBO Certification:

Project Name _____ MBE
 Project Location _____ WBE
 To _____ M/WBE
 Name of General Bidder/ Sub-bidder

1. This firm intends to perform work in connection with the above project.
2. This firm is currently certified by Executive Director of the Supplier Diversity Office (SDO) to perform the work identified below, and has not changed its minority/women ownership, control, or management without notifying SDO within thirty (30) days of such a change.
3. This firm understands that if the General Bidder/Sub-bidder referenced above is awarded the contract, the Bidder intends to enter into an agreement with this firm to perform the activity described below for the prices indicated. This firm also understands that the above-referenced firm, as General Bidder/Sub-bidder, will make substitutions only as allowed by Article XIII of the Contract.
4. This firm understands that under the terms of Article XIII of the contract, only work actually performed by an MBE/WBE will be credited toward MBE/WBE participation goals, and this firm cannot assign or subcontract out any of its work without prior written approval of the Owner's Project Manager, and that any such assignment or subcontracting will not be credited toward MBE/WBE participation goals.

MBE/WBE PARTICIPATION

Section/Item Number (if applicable)	Describe MBE/WBE Scopes of Work (clarify "Labor Only", "Material Only" or "Labor and Material")	If Supplier, Indicate Total Value of Supplies (10% of total counts toward Participation)	Dollar Value of Participation
.			

July 11, 2018

POPE'S TAVERN
ADDITION/RENOVATION
Halifax, Massachusetts

Total Dollar Value: \$ _____

Name of MBE/WBE Firm _____

Authorized Signature _____

Business Address _____

Print Name _____

Title _____

Telephone No _____ Fax No _____

Date _____

End of Document

July 11, 2018

POPE'S TAVERN
ADDITION/RENOVATION
Halifax, Massachusetts

CONTRACTOR PROGRESS PAYMENT REPORT
MINORITY/WOMEN BUSINESS ENTERPRISES PARTICIPATION
(SDO Exhibit C)

Project Number: _____
Project Name: _____
Project Location: _____
Date: _____
Periodical Payment No.: _____
General Contractor: _____
MBW and/or WBE: _____

One copy of this report is to be submitted for each Minority Business Enterprise (MBE) and/or Women Business Enterprise (WBE) at the time of submitting a request for payment. Copies of the report must be sent to the Minority Business Enterprise (MBE) and/or Women Business Enterprise (WBE) named above and to the municipalities Affirmative Marketing Construction Officer (AMCO). The AMCO will forward a copy of each Contractor Progress Payment Report to SDO on a quarterly basis.

1. The total price to be paid to the above-named Minority Business Enterprise ___ and/or Women Business Enterprise __: \$ _____.
2. The amount remitted to the Minority Business Enterprise and/or Women Business Enterprise as of the above date for work performed under this project: \$ _____.
3. Balance due the Minority Business Enterprise and/or Women Business Enterprise as of the above date for work performed under the above-named project: \$ _____.
4. Comments or explanation of the amounts indicated under items 2 and 2 above:

5. We hereby certify that the information supplied herein (including pages attached) is correct and complete:

General Contractor

Minority Business Enterprise and/or Women Business Enterprise

(Signed)

(Title)

(Date)

(Signed)

(Title)

(Date)

End of Document

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THIS PAGE INTENTIONALLY LEFT BLANK**



CHARLES D. BAKER
Governor

KARYN E. POLITO
Lt. Governor

THE COMMONWEALTH OF MASSACHUSETTS
EXECUTIVE OFFICE OF LABOR AND WORKFORCE DEVELOPMENT
DEPARTMENT OF LABOR STANDARDS

Prevailing Wage Rates

As determined by the Director under the provisions of the
Massachusetts General Laws, Chapter 149, Sections 26 to 27H

ROSALIN ACOSTA
Secretary

WILLIAM D MCKINNEY
Director

Awarding Authority: Town of Halifax
Contract Number: 2018-CoA **City/Town:** HALIFAX
Description of Work: Renovation and expansion of Pope's Tavern/Halifax Council on Aging.
Job Location: 506 Plymouth Street, Halifax, MA 02338

Information about Prevailing Wage Schedules for Awarding Authorities and Contractors

- This wage schedule applies only to the specific project referenced at the top of this page and uniquely identified by the “Wage Request Number” on all pages of this schedule.
- An Awarding Authority must request an updated wage schedule from the Department of Labor Standards (“DLS”) if it has not opened bids or selected a contractor within 90 days of the date of issuance of the wage schedule. For CM AT RISK projects (bid pursuant to G.L. c.149A), the earlier of: (a) the execution date of the GMP Amendment, or (b) the bid for the first construction scope of work must be within 90-days of the wage schedule issuance date.
- The wage schedule shall be incorporated in any advertisement or call for bids for the project as required by M.G.L. c. 149, § 27. The wage schedule shall be made a part of the contract awarded for the project. The wage schedule must be posted in a conspicuous place at the work site for the life of the project in accordance with M.G.L. c. 149 § 27. The wages listed on the wage schedule must be paid to employees performing construction work on the project whether they are employed by the prime contractor, a filed sub-bidder, or any sub-contractor.
- All apprentices working on the project are required to be registered with the Massachusetts Department of Labor Standards, Division of Apprentice Standards (DLS/DAS). Apprentice must keep his/her apprentice identification card on his/her person during all work hours on the project. An apprentice registered with DAS may be paid the lower apprentice wage rate at the applicable step as provided on the prevailing wage schedule. **Any apprentice not registered with DLS/DAS regardless of whether or not they are registered with any other federal, state, local, or private agency must be paid the journeyworker's rate for the trade.**
- The wage rates will remain in effect for the duration of the project, except in the case of multi-year public construction projects. For construction projects lasting longer than one year, awarding authorities must request an updated wage schedule. Awarding authorities are required to request these updates no later than two weeks before the anniversary of the date the contract was executed by the awarding authority and the general contractor. For multi-year CM AT RISK projects, awarding authority must request an annual update no later than two weeks before the anniversary date, determined as the earlier of: (a) the execution date of the GMP Amendment, or (b) the execution date of the first amendment to permit procurement of construction services. Contractors are required to obtain the wage schedules from awarding authorities, and to pay no less than these rates to covered workers. The annual update requirement is not applicable to 27F “rental of equipment” contracts.
- Every contractor or subcontractor which performs construction work on the project is required to submit weekly payroll reports and a Statement of Compliance directly to the awarding authority by mail or email and keep them on file for three years. Each weekly payroll report must contain: the employee’s name, address, occupational classification, hours worked, and wages paid. Do not submit weekly payroll reports to DLS. A sample of a payroll reporting form may be obtained at <http://www.mass.gov/dols/pw>.
- Contractors with questions about the wage rates or classifications included on the wage schedule have an affirmative obligation to inquire with DLS at (617) 626-6953.
- Employees not receiving the prevailing wage rate set forth on the wage schedule may report the violation to the Fair Labor Division of the office of the Attorney General at (617) 727-3465.
- Failure of a contractor or subcontractor to pay the prevailing wage rates listed on the wage schedule to all employees who perform construction work on the project is a violation of the law and subjects the contractor or subcontractor to civil and

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
Construction						
(2 AXLE) DRIVER - EQUIPMENT <i>TEAMSTERS JOINT COUNCIL NO. 10 ZONE B</i>	12/01/2016	\$32.15	\$10.91	\$10.89	\$0.00	\$53.95
(3 AXLE) DRIVER - EQUIPMENT <i>TEAMSTERS JOINT COUNCIL NO. 10 ZONE B</i>	12/01/2016	\$32.22	\$10.91	\$10.89	\$0.00	\$54.02
(4 & 5 AXLE) DRIVER - EQUIPMENT <i>TEAMSTERS JOINT COUNCIL NO. 10 ZONE B</i>	12/01/2016	\$32.34	\$10.91	\$10.89	\$0.00	\$54.14
ADS/SUBMERSIBLE PILOT <i>PILE DRIVER LOCAL 56 (ZONE 1)</i>	08/01/2017	\$92.97	\$9.90	\$21.15	\$0.00	\$124.02
	08/01/2018	\$97.80	\$9.90	\$21.15	\$0.00	\$128.85
	08/01/2019	\$102.78	\$9.90	\$21.15	\$0.00	\$133.83
For apprentice rates see "Apprentice- PILE DRIVER"						
AIR TRACK OPERATOR <i>LABORERS - ZONE 2</i>	06/01/2018	\$34.00	\$7.70	\$14.02	\$0.00	\$55.72
	12/01/2018	\$34.84	\$7.70	\$14.02	\$0.00	\$56.56
	06/01/2019	\$35.71	\$7.70	\$14.02	\$0.00	\$57.43
	12/01/2019	\$36.57	\$7.70	\$14.02	\$0.00	\$58.29
	06/01/2020	\$37.46	\$7.70	\$14.02	\$0.00	\$59.18
	12/01/2020	\$38.35	\$7.70	\$14.02	\$0.00	\$60.07
	06/01/2021	\$39.27	\$7.70	\$14.02	\$0.00	\$60.99
	12/01/2021	\$40.18	\$7.70	\$14.02	\$0.00	\$61.90
For apprentice rates see "Apprentice- LABORER"						
ASBESTOS REMOVER - PIPE / MECH. EQUIPT. <i>HEAT & FROST INSULATORS LOCAL 6 (BOSTON)</i>	06/01/2018	\$36.90	\$11.50	\$7.10	\$0.00	\$55.50
	12/01/2018	\$37.90	\$11.50	\$7.10	\$0.00	\$56.50
	06/01/2019	\$38.90	\$11.50	\$7.10	\$0.00	\$57.50
	12/01/2019	\$39.90	\$11.50	\$7.10	\$0.00	\$58.50
	06/01/2020	\$40.90	\$11.50	\$7.10	\$0.00	\$59.50
	12/01/2020	\$41.90	\$11.50	\$7.10	\$0.00	\$60.50
ASPHALT RAKER <i>LABORERS - ZONE 2</i>	06/01/2018	\$33.50	\$7.70	\$14.02	\$0.00	\$55.22
	12/01/2018	\$34.34	\$7.70	\$14.02	\$0.00	\$56.06
	06/01/2019	\$35.21	\$7.70	\$14.02	\$0.00	\$56.93
	12/01/2019	\$36.07	\$7.70	\$14.02	\$0.00	\$57.79
	06/01/2020	\$36.96	\$7.70	\$14.02	\$0.00	\$58.68
	12/01/2020	\$37.85	\$7.70	\$14.02	\$0.00	\$59.57
	06/01/2021	\$38.77	\$7.70	\$14.02	\$0.00	\$60.49
	12/01/2021	\$39.68	\$7.70	\$14.02	\$0.00	\$61.40
For apprentice rates see "Apprentice- LABORER"						
ASPHALT/CONCRETE/CRUSHER PLANT-ON SITE <i>OPERATING ENGINEERS LOCAL 4</i>	12/01/2017	\$46.63	\$10.50	\$15.50	\$0.00	\$72.63
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
BACKHOE/FRONT-END LOADER <i>OPERATING ENGINEERS LOCAL 4</i>	12/01/2017	\$46.63	\$10.50	\$15.50	\$0.00	\$72.63
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
BARCO-TYPE JUMPING TAMPER <i>LABORERS - ZONE 2</i>	06/01/2018	\$33.50	\$7.70	\$14.02	\$0.00	\$55.22
	12/01/2018	\$34.34	\$7.70	\$14.02	\$0.00	\$56.06
	06/01/2019	\$35.21	\$7.70	\$14.02	\$0.00	\$56.93
	12/01/2019	\$36.07	\$7.70	\$14.02	\$0.00	\$57.79
	06/01/2020	\$36.96	\$7.70	\$14.02	\$0.00	\$58.68
	12/01/2020	\$37.85	\$7.70	\$14.02	\$0.00	\$59.57
	06/01/2021	\$38.77	\$7.70	\$14.02	\$0.00	\$60.49
	12/01/2021	\$39.68	\$7.70	\$14.02	\$0.00	\$61.40

For apprentice rates see "Apprentice- LABORER"

BLOCK PAVER, RAMMER / CURB SETTER <i>LABORERS - ZONE 2</i>	06/01/2018	\$34.00	\$7.70	\$14.02	\$0.00	\$55.72
	12/01/2018	\$34.84	\$7.70	\$14.02	\$0.00	\$56.56
	06/01/2019	\$35.71	\$7.70	\$14.02	\$0.00	\$57.43
	12/01/2019	\$36.57	\$7.70	\$14.02	\$0.00	\$58.29
	06/01/2020	\$37.46	\$7.70	\$14.02	\$0.00	\$59.18
	12/01/2020	\$38.35	\$7.70	\$14.02	\$0.00	\$60.07
	06/01/2021	\$39.27	\$7.70	\$14.02	\$0.00	\$60.99
	12/01/2021	\$40.18	\$7.70	\$14.02	\$0.00	\$61.90

For apprentice rates see "Apprentice- LABORER"

BOILER MAKER <i>BOILERMAKERS LOCAL 29</i>	01/01/2017	\$42.92	\$6.97	\$16.21	\$0.00	\$66.10
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Apprentice - BOILERMAKER - Local 29

Effective Date - 01/01/2017

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	65	\$27.90	\$6.97	\$10.54	\$0.00	\$45.41
2	65	\$27.90	\$6.97	\$10.54	\$0.00	\$45.41
3	70	\$30.04	\$6.97	\$11.35	\$0.00	\$48.36
4	75	\$32.19	\$6.97	\$12.16	\$0.00	\$51.32
5	80	\$34.34	\$6.97	\$12.97	\$0.00	\$54.28
6	85	\$36.48	\$6.97	\$13.78	\$0.00	\$57.23
7	90	\$38.63	\$6.97	\$14.59	\$0.00	\$60.19
8	95	\$40.77	\$6.97	\$15.40	\$0.00	\$63.14

Notes:

Apprentice to Journeyworker Ratio:1:5

BRICK/STONE/ARTIFICIAL MASONRY (INCL. MASONRY WATERPROOFING) <i>BRICKLAYERS LOCAL 3 (QUINCY)</i>	02/01/2018	\$52.06	\$10.75	\$20.03	\$0.00	\$82.84
	08/01/2018	\$52.91	\$10.75	\$20.66	\$0.00	\$84.32
	02/01/2019	\$53.55	\$10.75	\$20.66	\$0.00	\$84.96
	08/01/2019	\$54.90	\$10.75	\$20.80	\$0.00	\$86.45
	02/01/2020	\$55.54	\$10.75	\$20.80	\$0.00	\$87.09
	08/01/2020	\$56.89	\$10.75	\$20.95	\$0.00	\$88.59
	02/01/2021	\$57.53	\$10.75	\$20.95	\$0.00	\$89.23
	08/01/2021	\$58.93	\$10.75	\$21.11	\$0.00	\$90.79
	02/01/2022	\$59.52	\$10.75	\$21.11	\$0.00	\$91.38

Classification

Effective Date Base Wage Health Pension Supplemental Unemployment Total Rate

Apprentice - BRICK/PLASTER/CEMENT MASON - Local 3 Quincy

Effective Date - 02/01/2018

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$26.03	\$10.75	\$20.03	\$0.00	\$56.81
2	60	\$31.24	\$10.75	\$20.03	\$0.00	\$62.02
3	70	\$36.44	\$10.75	\$20.03	\$0.00	\$67.22
4	80	\$41.65	\$10.75	\$20.03	\$0.00	\$72.43
5	90	\$46.85	\$10.75	\$20.03	\$0.00	\$77.63

Effective Date - 08/01/2018

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$26.46	\$10.75	\$20.66	\$0.00	\$57.87
2	60	\$31.75	\$10.75	\$20.66	\$0.00	\$63.16
3	70	\$37.04	\$10.75	\$20.66	\$0.00	\$68.45
4	80	\$42.33	\$10.75	\$20.66	\$0.00	\$73.74
5	90	\$47.62	\$10.75	\$20.66	\$0.00	\$79.03

Notes:

Apprentice to Journeyworker Ratio:1:5

BULLDOZER/GRADER/SCRAPER OPERATING ENGINEERS LOCAL 4	12/01/2017	\$46.17	\$10.50	\$15.50	\$0.00	\$72.17
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For apprentice rates see "Apprentice- OPERATING ENGINEERS"

CAISSON & UNDERPINNING BOTTOM MAN LABORERS - FOUNDATION AND MARINE	06/01/2018	\$39.10	\$7.70	\$15.40	\$0.00	\$62.20
	12/01/2018	\$40.05	\$7.70	\$15.40	\$0.00	\$63.15
	06/01/2019	\$41.05	\$7.70	\$15.40	\$0.00	\$64.15
	12/01/2019	\$42.05	\$7.70	\$15.40	\$0.00	\$65.15
	06/01/2020	\$43.04	\$7.70	\$15.40	\$0.00	\$66.14
	12/01/2020	\$44.02	\$7.70	\$15.40	\$0.00	\$67.12
	06/01/2021	\$45.04	\$7.70	\$15.40	\$0.00	\$68.14
	12/01/2021	\$46.05	\$7.70	\$15.40	\$0.00	\$69.15

For apprentice rates see "Apprentice- LABORER"

CAISSON & UNDERPINNING LABORER LABORERS - FOUNDATION AND MARINE	06/01/2018	\$37.95	\$7.70	\$15.40	\$0.00	\$61.05
	12/01/2018	\$38.90	\$7.70	\$15.40	\$0.00	\$62.00
	06/01/2019	\$39.90	\$7.70	\$15.40	\$0.00	\$63.00
	12/01/2019	\$40.90	\$7.70	\$15.40	\$0.00	\$64.00
	06/01/2020	\$41.89	\$7.70	\$15.40	\$0.00	\$64.99
	12/01/2020	\$42.87	\$7.70	\$15.40	\$0.00	\$65.97
	06/01/2021	\$43.89	\$7.70	\$15.40	\$0.00	\$66.99
	12/01/2021	\$44.90	\$7.70	\$15.40	\$0.00	\$68.00

For apprentice rates see "Apprentice- LABORER"

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
CAISSON & UNDERPINNING TOP MAN <i>LABORERS - FOUNDATION AND MARINE</i>	06/01/2018	\$37.95	\$7.70	\$15.40	\$0.00	\$61.05
	12/01/2018	\$38.90	\$7.70	\$15.40	\$0.00	\$62.00
	06/01/2019	\$39.90	\$7.70	\$15.40	\$0.00	\$63.00
	12/01/2019	\$40.90	\$7.70	\$15.40	\$0.00	\$64.00
	06/01/2020	\$41.89	\$7.70	\$15.40	\$0.00	\$64.99
	12/01/2020	\$42.87	\$7.70	\$15.40	\$0.00	\$65.97
	06/01/2021	\$43.89	\$7.70	\$15.40	\$0.00	\$66.99
	12/01/2021	\$44.90	\$7.70	\$15.40	\$0.00	\$68.00
For apprentice rates see "Apprentice- LABORER"						
CARBIDE CORE DRILL OPERATOR <i>LABORERS - ZONE 2</i>	06/01/2018	\$33.50	\$7.70	\$14.02	\$0.00	\$55.22
	12/01/2018	\$34.34	\$7.70	\$14.02	\$0.00	\$56.06
	06/01/2019	\$35.21	\$7.70	\$14.02	\$0.00	\$56.93
	12/01/2019	\$36.07	\$7.70	\$14.02	\$0.00	\$57.79
	06/01/2020	\$36.96	\$7.70	\$14.02	\$0.00	\$58.68
	12/01/2020	\$37.85	\$7.70	\$14.02	\$0.00	\$59.57
	06/01/2021	\$38.77	\$7.70	\$14.02	\$0.00	\$60.49
	12/01/2021	\$39.68	\$7.70	\$14.02	\$0.00	\$61.40
For apprentice rates see "Apprentice- LABORER"						
CARPENTER <i>CARPENTERS -ZONE 2 (Eastern Massachusetts)</i>	03/01/2018	\$40.28	\$9.90	\$17.50	\$0.00	\$67.68
	09/01/2018	\$41.32	\$9.90	\$17.50	\$0.00	\$68.72
	03/01/2019	\$42.35	\$9.90	\$17.50	\$0.00	\$69.75

Classification

Effective Date Base Wage Health Pension Supplemental Unemployment Total Rate

Apprentice - CARPENTER - Zone 2 Eastern MA

Effective Date - 03/01/2018

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$20.14	\$9.90	\$1.73	\$0.00	\$31.77
2	60	\$24.17	\$9.90	\$1.73	\$0.00	\$35.80
3	70	\$28.20	\$9.90	\$12.31	\$0.00	\$50.41
4	75	\$30.21	\$9.90	\$12.31	\$0.00	\$52.42
5	80	\$32.22	\$9.90	\$14.04	\$0.00	\$56.16
6	80	\$32.22	\$9.90	\$14.04	\$0.00	\$56.16
7	90	\$36.25	\$9.90	\$15.77	\$0.00	\$61.92
8	90	\$36.25	\$9.90	\$15.77	\$0.00	\$61.92

Effective Date - 09/01/2018

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$20.66	\$9.90	\$1.73	\$0.00	\$32.29
2	60	\$24.79	\$9.90	\$1.73	\$0.00	\$36.42
3	70	\$28.92	\$9.90	\$12.31	\$0.00	\$51.13
4	75	\$30.99	\$9.90	\$12.31	\$0.00	\$53.20
5	80	\$33.06	\$9.90	\$14.04	\$0.00	\$57.00
6	80	\$33.06	\$9.90	\$14.04	\$0.00	\$57.00
7	90	\$37.19	\$9.90	\$15.77	\$0.00	\$62.86
8	90	\$37.19	\$9.90	\$15.77	\$0.00	\$62.86

Notes:

% Indentured After 10/1/17; 45/45/55/55/70/70/80/80
 Step 1&2 \$29.76/ 3&4 \$35.45/ 5&6 \$52.14/ 7&8 \$57.89

Apprentice to Journeyworker Ratio:1:5

CARPENTER WOOD FRAME	04/01/2018	\$26.67	\$7.07	\$7.86	\$0.00	\$41.60
CARPENTERS -ZONE 2 (Wood Frame)	10/01/2018	\$27.09	\$7.07	\$7.86	\$0.00	\$42.02
	04/01/2019	\$27.52	\$7.07	\$7.86	\$0.00	\$42.45
	10/01/2019	\$27.95	\$7.07	\$7.86	\$0.00	\$42.88

As of 9/1/09 Carpentry work on wood-frame WEATHERIZATION projects shall be paid the WOOD FRAME CARPENTER rate.

Classification

Effective Date Base Wage Health Pension Supplemental Unemployment Total Rate

Apprentice - CARPENTER (Wood Frame) - Zone 2

Effective Date - 04/01/2018

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	60	\$16.00	\$7.07	\$0.00	\$0.00	\$23.07
2	60	\$16.00	\$7.07	\$0.00	\$0.00	\$23.07
3	65	\$17.34	\$7.07	\$7.86	\$0.00	\$32.27
4	70	\$18.67	\$7.07	\$7.86	\$0.00	\$33.60
5	75	\$20.00	\$7.07	\$7.86	\$0.00	\$34.93
6	80	\$21.34	\$7.07	\$7.86	\$0.00	\$36.27
7	85	\$22.67	\$7.07	\$7.86	\$0.00	\$37.60
8	90	\$24.00	\$7.07	\$7.86	\$0.00	\$38.93

Effective Date - 10/01/2018

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	60	\$16.25	\$7.07	\$0.00	\$0.00	\$23.32
2	60	\$16.25	\$7.07	\$0.00	\$0.00	\$23.32
3	65	\$17.61	\$7.07	\$7.86	\$0.00	\$32.54
4	70	\$18.96	\$7.07	\$7.86	\$0.00	\$33.89
5	75	\$20.32	\$7.07	\$7.86	\$0.00	\$35.25
6	80	\$21.67	\$7.07	\$7.86	\$0.00	\$36.60
7	85	\$23.03	\$7.07	\$7.86	\$0.00	\$37.96
8	90	\$24.38	\$7.07	\$7.86	\$0.00	\$39.31

Notes:

% Indentured After 10/1/17; 45/45/55/55/70/70/80/80
 Step 1&2 \$19.07/ 3&4 \$26.49/ 5&6 \$33.60/ 7&8 \$36.27

Apprentice to Journeyworker Ratio:1:5

CARPENTER WOOD FRAME (All Other Work) CARPENTERS -ZONE 2 (Wood Frame)	06/01/2016	\$25.32	\$9.80	\$16.82	\$0.00	\$51.94
CEMENT MASONRY/PLASTERING BRICKLAYERS LOCAL 3 (QUINCY)	07/01/2018	\$46.20	\$12.42	\$22.41	\$0.30	\$81.33
	01/01/2019	\$47.58	\$12.42	\$22.41	\$0.30	\$82.71
	07/01/2019	\$48.32	\$12.42	\$22.41	\$0.30	\$83.45
	01/01/2020	\$49.72	\$12.42	\$22.41	\$0.30	\$84.85

Classification

Effective Date Base Wage Health Pension Supplemental Unemployment Total Rate

Apprentice - CEMENT MASONRY/PLASTERING - Eastern Mass (Quincy)

Effective Date - 07/01/2018

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$23.10	\$12.42	\$15.41	\$0.00	\$50.93
2	60	\$27.72	\$12.42	\$17.41	\$0.30	\$57.85
3	65	\$30.03	\$12.42	\$18.41	\$0.30	\$61.16
4	70	\$32.34	\$12.42	\$19.41	\$0.30	\$64.47
5	75	\$34.65	\$12.42	\$20.41	\$0.30	\$67.78
6	80	\$36.96	\$12.42	\$21.41	\$0.30	\$71.09
7	90	\$41.58	\$12.42	\$22.41	\$0.30	\$76.71

Effective Date - 01/01/2019

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$23.79	\$12.42	\$15.41	\$0.00	\$51.62
2	60	\$28.55	\$12.42	\$17.41	\$0.30	\$58.68
3	65	\$30.93	\$12.42	\$18.41	\$0.30	\$62.06
4	70	\$33.31	\$12.42	\$19.41	\$0.30	\$65.44
5	75	\$35.69	\$12.42	\$20.41	\$0.30	\$68.82
6	80	\$38.06	\$12.42	\$21.41	\$0.30	\$72.19
7	90	\$42.82	\$12.42	\$22.41	\$0.30	\$77.95

Notes:
Steps 3,4 are 500 hrs. All other steps are 1,000 hrs.

Apprentice to Journeyworker Ratio:1:3

CHAIN SAW OPERATOR LABORERS - ZONE 2	06/01/2018	\$33.50	\$7.70	\$14.02	\$0.00	\$55.22
	12/01/2018	\$34.34	\$7.70	\$14.02	\$0.00	\$56.06
	06/01/2019	\$35.21	\$7.70	\$14.02	\$0.00	\$56.93
	12/01/2019	\$36.07	\$7.70	\$14.02	\$0.00	\$57.79
	06/01/2020	\$36.96	\$7.70	\$14.02	\$0.00	\$58.68
	12/01/2020	\$37.85	\$7.70	\$14.02	\$0.00	\$59.57
	06/01/2021	\$38.77	\$7.70	\$14.02	\$0.00	\$60.49
	12/01/2021	\$39.68	\$7.70	\$14.02	\$0.00	\$61.40

For apprentice rates see "Apprentice- LABORER"

CLAM SHELLS/SLURRY BUCKETS/HEADING MACHINES OPERATING ENGINEERS LOCAL 4	12/01/2017	\$47.63	\$10.50	\$15.50	\$0.00	\$73.63
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For apprentice rates see "Apprentice- OPERATING ENGINEERS"

COMPRESSOR OPERATOR OPERATING ENGINEERS LOCAL 4	12/01/2017	\$31.80	\$10.50	\$15.50	\$0.00	\$57.80
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For apprentice rates see "Apprentice- OPERATING ENGINEERS"

DELEADER (BRIDGE) PAINTERS LOCAL 35 - ZONE 2	07/01/2018	\$50.01	\$8.15	\$20.15	\$0.00	\$78.31
	01/01/2019	\$50.36	\$8.15	\$20.85	\$0.00	\$79.36
	07/01/2019	\$51.46	\$8.15	\$20.85	\$0.00	\$80.46
	01/01/2020	\$52.56	\$8.15	\$20.85	\$0.00	\$81.56
	07/01/2020	\$53.66	\$8.15	\$20.85	\$0.00	\$82.66
	01/01/2021	\$54.76	\$8.15	\$20.85	\$0.00	\$83.76

Classification

Effective Date Base Wage Health Pension Supplemental Unemployment Total Rate

Apprentice - PAINTER Local 35 - BRIDGES/TANKS

Effective Date - 07/01/2018

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$25.01	\$8.15	\$0.00	\$0.00	\$33.16
2	55	\$27.51	\$8.15	\$5.34	\$0.00	\$41.00
3	60	\$30.01	\$8.15	\$5.82	\$0.00	\$43.98
4	65	\$32.51	\$8.15	\$6.31	\$0.00	\$46.97
5	70	\$35.01	\$8.15	\$17.24	\$0.00	\$60.40
6	75	\$37.51	\$8.15	\$17.73	\$0.00	\$63.39
7	80	\$40.01	\$8.15	\$18.21	\$0.00	\$66.37
8	90	\$45.01	\$8.15	\$19.18	\$0.00	\$72.34

Effective Date - 01/01/2019

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$25.18	\$8.15	\$0.00	\$0.00	\$33.33
2	55	\$27.70	\$8.15	\$5.64	\$0.00	\$41.49
3	60	\$30.22	\$8.15	\$6.15	\$0.00	\$44.52
4	65	\$32.73	\$8.15	\$6.66	\$0.00	\$47.54
5	70	\$35.25	\$8.15	\$17.78	\$0.00	\$61.18
6	75	\$37.77	\$8.15	\$18.29	\$0.00	\$64.21
7	80	\$40.29	\$8.15	\$18.80	\$0.00	\$67.24
8	90	\$45.32	\$8.15	\$19.83	\$0.00	\$73.30

Notes:

Steps are 750 hrs.

Apprentice to Journeyworker Ratio:1:1

DEMO: ADZEMAN LABORERS - ZONE 2	06/01/2018	\$38.15	\$7.70	\$15.20	\$0.00	\$61.05
	12/01/2018	\$39.10	\$7.70	\$15.20	\$0.00	\$62.00
	06/01/2019	\$40.10	\$7.70	\$15.20	\$0.00	\$63.00
	12/01/2019	\$41.10	\$7.70	\$15.20	\$0.00	\$64.00

For apprentice rates see "Apprentice- LABORER"

DEMO: BACKHOE/LOADER/HAMMER OPERATOR LABORERS - ZONE 2	06/01/2018	\$39.15	\$7.70	\$15.20	\$0.00	\$62.05
	12/01/2018	\$40.10	\$7.70	\$15.20	\$0.00	\$63.00
	06/01/2019	\$41.10	\$7.70	\$15.20	\$0.00	\$64.00
	12/01/2019	\$42.10	\$7.70	\$15.20	\$0.00	\$65.00

For apprentice rates see "Apprentice- LABORER"

DEMO: BURNERS LABORERS - ZONE 2	06/01/2018	\$38.90	\$7.70	\$15.20	\$0.00	\$61.80
	12/01/2018	\$39.85	\$7.70	\$15.20	\$0.00	\$62.75
	06/01/2019	\$40.85	\$7.70	\$15.20	\$0.00	\$63.75
	12/01/2019	\$41.85	\$7.70	\$15.20	\$0.00	\$64.75

For apprentice rates see "Apprentice- LABORER"

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
DEMO: CONCRETE CUTTER/SAWYER <i>LABORERS - ZONE 2</i>	06/01/2018	\$39.15	\$7.70	\$15.20	\$0.00	\$62.05
	12/01/2018	\$40.10	\$7.70	\$15.20	\$0.00	\$63.00
	06/01/2019	\$41.10	\$7.70	\$15.20	\$0.00	\$64.00
	12/01/2019	\$42.10	\$7.70	\$15.20	\$0.00	\$65.00
For apprentice rates see "Apprentice- LABORER"						
DEMO: JACKHAMMER OPERATOR <i>LABORERS - ZONE 2</i>	06/01/2018	\$38.90	\$7.70	\$15.20	\$0.00	\$61.80
	12/01/2018	\$39.85	\$7.70	\$15.20	\$0.00	\$62.75
	06/01/2019	\$40.85	\$7.70	\$15.20	\$0.00	\$63.75
	12/01/2019	\$41.85	\$7.70	\$15.20	\$0.00	\$64.75
For apprentice rates see "Apprentice- LABORER"						
DEMO: WRECKING LABORER <i>LABORERS - ZONE 2</i>	06/01/2018	\$38.15	\$7.70	\$15.20	\$0.00	\$61.05
	12/01/2018	\$39.10	\$7.70	\$15.20	\$0.00	\$62.00
	06/01/2019	\$40.10	\$7.70	\$15.20	\$0.00	\$63.00
	12/01/2019	\$41.10	\$7.70	\$15.20	\$0.00	\$64.00
For apprentice rates see "Apprentice- LABORER"						
DIRECTIONAL DRILL MACHINE OPERATOR <i>OPERATING ENGINEERS LOCAL 4</i>	12/01/2017	\$46.17	\$10.50	\$15.50	\$0.00	\$72.17
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
DIVER <i>PILE DRIVER LOCAL 56 (ZONE 1)</i>	08/01/2017	\$61.98	\$9.90	\$21.15	\$0.00	\$93.03
	08/01/2018	\$65.20	\$9.90	\$21.15	\$0.00	\$96.25
	08/01/2019	\$68.52	\$9.90	\$21.15	\$0.00	\$99.57
For apprentice rates see "Apprentice- PILE DRIVER"						
DIVER TENDER <i>PILE DRIVER LOCAL 56 (ZONE 1)</i>	08/01/2017	\$44.27	\$9.90	\$21.15	\$0.00	\$75.32
	08/01/2018	\$46.57	\$9.90	\$21.15	\$0.00	\$77.62
	08/01/2019	\$48.94	\$9.90	\$21.15	\$0.00	\$79.99
For apprentice rates see "Apprentice- PILE DRIVER"						
DIVER TENDER (EFFLUENT) <i>PILE DRIVER LOCAL 56 (ZONE 1)</i>	08/01/2017	\$66.41	\$9.90	\$21.15	\$0.00	\$97.46
	08/01/2018	\$69.86	\$9.90	\$21.15	\$0.00	\$100.91
	08/01/2019	\$73.41	\$9.90	\$21.15	\$0.00	\$104.46
For apprentice rates see "Apprentice- PILE DRIVER"						
DIVER/SLURRY (EFFLUENT) <i>PILE DRIVER LOCAL 56 (ZONE 1)</i>	08/01/2017	\$92.97	\$9.90	\$21.15	\$0.00	\$124.02
	08/01/2018	\$97.80	\$9.90	\$21.15	\$0.00	\$128.85
	08/01/2019	\$102.78	\$9.90	\$21.15	\$0.00	\$133.83
For apprentice rates see "Apprentice- PILE DRIVER"						
ELECTRICIAN <i>ELECTRICIANS LOCAL 223</i>	03/01/2018	\$40.42	\$9.40	\$12.34	\$0.00	\$62.16
	09/01/2018	\$41.03	\$9.65	\$12.74	\$0.00	\$63.42
	03/01/2019	\$41.64	\$9.90	\$13.15	\$0.00	\$64.69
	09/01/2019	\$42.26	\$10.15	\$13.54	\$0.00	\$65.95
	03/01/2020	\$42.87	\$10.40	\$13.94	\$0.00	\$67.21

Apprentice - ELECTRICIAN - Local 223

Effective Date - 03/01/2018

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	40	\$16.17	\$0.00	\$0.49	\$0.00	\$16.66
2	42	\$16.98	\$0.00	\$0.51	\$0.00	\$17.49
3	45	\$18.19	\$9.40	\$0.55	\$0.00	\$28.14
4	48	\$19.40	\$9.40	\$4.00	\$0.00	\$32.80
5	50	\$20.21	\$9.40	\$4.30	\$0.00	\$33.91
6	55	\$22.23	\$9.40	\$4.45	\$0.00	\$36.08
7	60	\$24.25	\$9.40	\$4.74	\$0.00	\$38.39
8	65	\$26.27	\$9.40	\$5.04	\$0.00	\$40.71
9	70	\$28.29	\$9.40	\$5.33	\$0.00	\$43.02
10	75	\$30.32	\$9.40	\$5.62	\$0.00	\$45.34

Effective Date - 09/01/2018

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	40	\$16.41	\$9.65	\$0.49	\$0.00	\$26.55
2	42	\$17.23	\$9.65	\$0.52	\$0.00	\$27.40
3	45	\$18.46	\$9.65	\$0.58	\$0.00	\$28.69
4	48	\$19.69	\$9.65	\$4.35	\$0.00	\$33.69
5	50	\$20.52	\$9.65	\$4.45	\$0.00	\$34.62
6	55	\$22.57	\$9.65	\$4.75	\$0.00	\$36.97
7	60	\$24.62	\$9.65	\$5.04	\$0.00	\$39.31
8	65	\$26.67	\$9.65	\$5.34	\$0.00	\$41.66
9	70	\$28.72	\$9.65	\$5.63	\$0.00	\$44.00
10	75	\$30.77	\$9.65	\$5.87	\$0.00	\$46.29

Notes:

Steps are 750 hours

Apprentice to Journeyworker Ratio:2:3***

ELEVATOR CONSTRUCTOR	01/01/2018	\$57.62	\$15.43	\$16.61	\$0.00	\$89.66
ELEVATOR CONSTRUCTORS LOCAL 4	01/01/2019	\$59.47	\$15.58	\$17.51	\$0.00	\$92.56
	01/01/2020	\$61.42	\$15.73	\$18.41	\$0.00	\$95.56
	01/01/2021	\$63.47	\$15.88	\$19.31	\$0.00	\$98.66
	01/01/2022	\$65.62	\$16.03	\$20.21	\$0.00	\$101.86

Classification

Effective Date Base Wage Health Pension Supplemental Unemployment Total Rate

Apprentice - ELEVATOR CONSTRUCTOR - Local 4

Effective Date - 01/01/2018

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$28.81	\$15.43	\$0.00	\$0.00	\$44.24
2	55	\$31.69	\$15.43	\$16.61	\$0.00	\$63.73
3	65	\$37.45	\$15.43	\$16.61	\$0.00	\$69.49
4	70	\$40.33	\$15.43	\$16.61	\$0.00	\$72.37
5	80	\$46.10	\$15.43	\$16.61	\$0.00	\$78.14

Effective Date - 01/01/2019

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$29.74	\$15.58	\$0.00	\$0.00	\$45.32
2	55	\$32.71	\$15.58	\$17.51	\$0.00	\$65.80
3	65	\$38.66	\$15.58	\$17.51	\$0.00	\$71.75
4	70	\$41.63	\$15.58	\$17.51	\$0.00	\$74.72
5	80	\$47.58	\$15.58	\$17.51	\$0.00	\$80.67

Notes:

Steps 1-2 are 6 mos.; Steps 3-5 are 1 year

Apprentice to Journeyworker Ratio:1:1

ELEVATOR CONSTRUCTOR HELPER ELEVATOR CONSTRUCTORS LOCAL 4	01/01/2018	\$40.33	\$15.43	\$16.61	\$0.00	\$72.37
	01/01/2019	\$41.63	\$15.58	\$17.51	\$0.00	\$74.72
	01/01/2020	\$42.99	\$15.73	\$18.41	\$0.00	\$77.13
	01/01/2021	\$44.43	\$15.88	\$19.31	\$0.00	\$79.62
	01/01/2022	\$45.93	\$16.03	\$20.21	\$0.00	\$82.17

For apprentice rates see "Apprentice - ELEVATOR CONSTRUCTOR"

FENCE & GUARD RAIL ERECTOR LABORERS - ZONE 2	06/01/2018	\$33.50	\$7.70	\$14.02	\$0.00	\$55.22
	12/01/2018	\$34.34	\$7.70	\$14.02	\$0.00	\$56.06
	06/01/2019	\$35.21	\$7.70	\$14.02	\$0.00	\$56.93
	12/01/2019	\$36.07	\$7.70	\$14.02	\$0.00	\$57.79
	06/01/2020	\$36.96	\$7.70	\$14.02	\$0.00	\$58.68
	12/01/2020	\$37.85	\$7.70	\$14.02	\$0.00	\$59.57
	06/01/2021	\$38.77	\$7.70	\$14.02	\$0.00	\$60.49
	12/01/2021	\$39.68	\$7.70	\$14.02	\$0.00	\$61.40

For apprentice rates see "Apprentice- LABORER"

FIELD ENG.INST.PERSON-BLDG,SITE,HVY/HWY OPERATING ENGINEERS LOCAL 4	05/01/2018	\$42.84	\$10.50	\$15.50	\$0.00	\$68.84
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For apprentice rates see "Apprentice- OPERATING ENGINEERS"

FIELD ENG.PARTY CHIEF-BLDG,SITE,HVY/HWY OPERATING ENGINEERS LOCAL 4	05/01/2018	\$44.31	\$10.50	\$15.50	\$0.00	\$70.31
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For apprentice rates see "Apprentice- OPERATING ENGINEERS"

FIELD ENG.ROD PERSON-BLDG,SITE,HVY/HWY OPERATING ENGINEERS LOCAL 4	05/01/2018	\$22.51	\$10.50	\$15.50	\$0.00	\$48.51
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For apprentice rates see "Apprentice- OPERATING ENGINEERS"

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
FIRE ALARM INSTALLER <i>ELECTRICIANS LOCAL 223</i>	03/01/2018	\$40.42	\$9.40	\$12.34	\$0.00	\$62.16
	09/01/2018	\$41.03	\$9.65	\$12.74	\$0.00	\$63.42
	03/01/2019	\$41.64	\$9.90	\$13.15	\$0.00	\$64.69
	09/01/2019	\$42.26	\$10.15	\$13.54	\$0.00	\$65.95
	03/01/2020	\$42.87	\$10.40	\$13.94	\$0.00	\$67.21
For apprentice rates see "Apprentice- ELECTRICIAN"						
FIRE ALARM REPAIR / MAINTENANCE <i>LOCAL 223</i> / COMMISSIONING <i>ELECTRICIANS</i>	03/01/2018	\$34.27	\$9.40	\$10.46	\$0.00	\$54.13
	09/01/2018	\$34.76	\$9.65	\$10.81	\$0.00	\$55.22
	03/01/2019	\$35.25	\$9.90	\$11.14	\$0.00	\$56.29
	09/01/2019	\$35.78	\$10.15	\$11.45	\$0.00	\$57.38
	03/01/2020	\$36.27	\$10.40	\$11.78	\$0.00	\$58.45
For apprentice rates see "Apprentice- TELECOMMUNICATIONS TECHNICIAN"						
FIREMAN (ASST. ENGINEER) <i>OPERATING ENGINEERS LOCAL 4</i>	12/01/2017	\$38.57	\$10.50	\$15.50	\$0.00	\$64.57
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
FLAGGER & SIGNALER <i>LABORERS - ZONE 2</i>	06/01/2018	\$21.50	\$7.70	\$14.02	\$0.00	\$43.22
	12/01/2018	\$22.50	\$7.70	\$14.02	\$0.00	\$44.22
	06/01/2019	\$22.50	\$7.70	\$14.02	\$0.00	\$44.22
	12/01/2019	\$23.50	\$7.70	\$14.02	\$0.00	\$45.22
	06/01/2020	\$23.50	\$7.70	\$14.02	\$0.00	\$45.22
	12/01/2020	\$24.50	\$7.70	\$14.02	\$0.00	\$46.22
	06/01/2021	\$24.50	\$7.70	\$14.02	\$0.00	\$46.22
	12/01/2021	\$24.50	\$7.70	\$14.02	\$0.00	\$46.22
For apprentice rates see "Apprentice- LABORER"						
FLOORCOVERER <i>FLOORCOVERERS LOCAL 2168 ZONE 1</i>	03/01/2016	\$42.13	\$9.80	\$17.62	\$0.00	\$69.55

Apprentice - FLOORCOVERER - Local 2168 Zone 1

Effective Date - 03/01/2016

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$21.07	\$9.80	\$1.79	\$0.00	\$32.66
2	55	\$23.17	\$9.80	\$1.79	\$0.00	\$34.76
3	60	\$25.28	\$9.80	\$12.25	\$0.00	\$47.33
4	65	\$27.38	\$9.80	\$12.25	\$0.00	\$49.43
5	70	\$29.49	\$9.80	\$14.04	\$0.00	\$53.33
6	75	\$31.60	\$9.80	\$14.04	\$0.00	\$55.44
7	80	\$33.70	\$9.80	\$15.83	\$0.00	\$59.33
8	85	\$35.81	\$9.80	\$15.83	\$0.00	\$61.44

Notes: Steps are 750 hrs.
 % After 09/1/17; 45/45/55/55/70/70/80/80 (1500hr Steps)
 Step 1&2 \$30.55/ 3&4 \$36.49/ 5&6 \$53.33/ 7&8 \$59.33

Apprentice to Journeyworker Ratio:1:1

FORK LIFT/CHERRY PICKER <i>OPERATING ENGINEERS LOCAL 4</i>	12/01/2017	\$46.63	\$10.50	\$15.50	\$0.00	\$72.63
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For apprentice rates see "Apprentice- OPERATING ENGINEERS"

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
GENERATOR/LIGHTING PLANT/HEATERS <i>OPERATING ENGINEERS LOCAL 4</i>	12/01/2017	\$31.80	\$10.50	\$15.50	\$0.00	\$57.80
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
GLAZIER (GLASS PLANK/AIR BARRIER/INTERIOR SYSTEMS) <i>GLAZIERS LOCAL 35 (ZONE 2)</i>	07/01/2018	\$39.51	\$8.15	\$20.15	\$0.00	\$67.81
	01/01/2019	\$39.86	\$8.15	\$20.85	\$0.00	\$68.86
	07/01/2019	\$40.96	\$8.15	\$20.85	\$0.00	\$69.96
	01/01/2020	\$42.06	\$8.15	\$20.85	\$0.00	\$71.06
	07/01/2020	\$43.16	\$8.15	\$20.85	\$0.00	\$72.16
	01/01/2021	\$44.26	\$8.15	\$20.85	\$0.00	\$73.26

Apprentice - GLAZIER - Local 35 Zone 2

Effective Date - 07/01/2018

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$19.76	\$8.15	\$0.00	\$0.00	\$27.91
2	55	\$21.73	\$8.15	\$5.34	\$0.00	\$35.22
3	60	\$23.71	\$8.15	\$5.82	\$0.00	\$37.68
4	65	\$25.68	\$8.15	\$6.31	\$0.00	\$40.14
5	70	\$27.66	\$8.15	\$17.24	\$0.00	\$53.05
6	75	\$29.63	\$8.15	\$17.73	\$0.00	\$55.51
7	80	\$31.61	\$8.15	\$18.21	\$0.00	\$57.97
8	90	\$35.56	\$8.15	\$19.18	\$0.00	\$62.89

Effective Date - 01/01/2019

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$19.93	\$8.15	\$0.00	\$0.00	\$28.08
2	55	\$21.92	\$8.15	\$5.64	\$0.00	\$35.71
3	60	\$23.92	\$8.15	\$6.15	\$0.00	\$38.22
4	65	\$25.91	\$8.15	\$6.66	\$0.00	\$40.72
5	70	\$27.90	\$8.15	\$17.78	\$0.00	\$53.83
6	75	\$29.90	\$8.15	\$18.29	\$0.00	\$56.34
7	80	\$31.89	\$8.15	\$18.80	\$0.00	\$58.84
8	90	\$35.87	\$8.15	\$19.83	\$0.00	\$63.85

Notes:

Steps are 750 hrs.

Apprentice to Journeyworker Ratio:1:1

HOISTING ENGINEER/CRANES/GRADALLS <i>OPERATING ENGINEERS LOCAL 4</i>	12/01/2017	\$46.63	\$10.50	\$15.50	\$0.00	\$72.63
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Apprentice - OPERATING ENGINEERS - Local 4

Effective Date - 12/01/2017

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	55	\$25.65	\$10.50	\$0.00	\$0.00	\$36.15
2	60	\$27.98	\$10.50	\$15.50	\$0.00	\$53.98
3	65	\$30.31	\$10.50	\$15.50	\$0.00	\$56.31
4	70	\$32.64	\$10.50	\$15.50	\$0.00	\$58.64
5	75	\$34.97	\$10.50	\$15.50	\$0.00	\$60.97
6	80	\$37.30	\$10.50	\$15.50	\$0.00	\$63.30
7	85	\$39.64	\$10.50	\$15.50	\$0.00	\$65.64
8	90	\$41.97	\$10.50	\$15.50	\$0.00	\$67.97

Notes:

Apprentice to Journeyworker Ratio:1:6

HVAC (DUCTWORK) SHEETMETAL WORKERS LOCAL 17 - A	02/01/2018	\$44.11	\$12.20	\$24.12	\$2.41	\$82.84
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For apprentice rates see "Apprentice- SHEET METAL WORKER"

HVAC (ELECTRICAL CONTROLS) ELECTRICIANS LOCAL 223	03/01/2018	\$40.42	\$9.40	\$12.34	\$0.00	\$62.16
	09/01/2018	\$41.03	\$9.65	\$12.74	\$0.00	\$63.42
	03/01/2019	\$41.64	\$9.90	\$13.15	\$0.00	\$64.69
	09/01/2019	\$42.26	\$10.15	\$13.54	\$0.00	\$65.95
	03/01/2020	\$42.87	\$10.40	\$13.94	\$0.00	\$67.21

For apprentice rates see "Apprentice- ELECTRICIAN"

HVAC (TESTING AND BALANCING - AIR) SHEETMETAL WORKERS LOCAL 17 - A	02/01/2018	\$44.11	\$12.20	\$24.12	\$2.41	\$82.84
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For apprentice rates see "Apprentice- SHEET METAL WORKER"

HVAC (TESTING AND BALANCING - WATER) PLUMBERS & PIPEFITTERS LOCAL 51	09/01/2017	\$40.69	\$10.00	\$17.60	\$0.00	\$68.29
	09/01/2018	\$42.69	\$10.00	\$17.60	\$0.00	\$70.29

For apprentice rates see "Apprentice- PIPEFITTER" or "PLUMBER/PIPEFITTER"

HVAC MECHANIC PLUMBERS & PIPEFITTERS LOCAL 51	09/01/2017	\$40.69	\$10.00	\$17.60	\$0.00	\$68.29
	09/01/2018	\$42.69	\$10.00	\$17.60	\$0.00	\$70.29

For apprentice rates see "Apprentice- PIPEFITTER" or "PLUMBER/PIPEFITTER"

HYDRAULIC DRILLS LABORERS - ZONE 2	06/01/2018	\$34.00	\$7.70	\$14.02	\$0.00	\$55.72
	12/01/2018	\$34.84	\$7.70	\$14.02	\$0.00	\$56.56
	06/01/2019	\$35.71	\$7.70	\$14.02	\$0.00	\$57.43
	12/01/2019	\$36.57	\$7.70	\$14.02	\$0.00	\$58.29
	06/01/2020	\$37.46	\$7.70	\$14.02	\$0.00	\$59.18
	12/01/2020	\$38.35	\$7.70	\$14.02	\$0.00	\$60.07
	06/01/2021	\$39.27	\$7.70	\$14.02	\$0.00	\$60.99
	12/01/2021	\$40.18	\$7.70	\$14.02	\$0.00	\$61.90

For apprentice rates see "Apprentice- LABORER"

INSULATOR (PIPES & TANKS) HEAT & FROST INSULATORS LOCAL 6 (BOSTON)	09/01/2017	\$47.09	\$11.75	\$14.20	\$0.00	\$73.04
	09/01/2018	\$49.34	\$11.75	\$14.20	\$0.00	\$75.29
	09/01/2019	\$51.84	\$11.75	\$14.20	\$0.00	\$77.79

Classification

Effective Date Base Wage Health Pension Supplemental Unemployment Total Rate

Apprentice - ASBESTOS INSULATOR (Pipes & Tanks) - Local 6 Boston

Effective Date - 09/01/2017

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$23.55	\$11.75	\$10.45	\$0.00	\$45.75
2	60	\$28.25	\$11.75	\$11.20	\$0.00	\$51.20
3	70	\$32.96	\$11.75	\$11.95	\$0.00	\$56.66
4	80	\$37.67	\$11.75	\$12.70	\$0.00	\$62.12

Effective Date - 09/01/2018

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$24.67	\$11.75	\$10.45	\$0.00	\$46.87
2	60	\$29.60	\$11.75	\$11.20	\$0.00	\$52.55
3	70	\$34.54	\$11.75	\$11.95	\$0.00	\$58.24
4	80	\$39.47	\$11.75	\$12.70	\$0.00	\$63.92

Notes:

Steps are 1 year

Apprentice to Journeyworker Ratio:1:4

IRONWORKER/WELDER <i>IRONWORKERS LOCAL 7 (BOSTON AREA)</i>	03/16/2017	\$44.65	\$7.80	\$20.85	\$0.00	\$73.30
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Apprentice - IRONWORKER - Local 7 Boston

Effective Date - 03/16/2017

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	60	\$26.79	\$7.80	\$20.85	\$0.00	\$55.44
2	70	\$31.26	\$7.80	\$20.85	\$0.00	\$59.91
3	75	\$33.49	\$7.80	\$20.85	\$0.00	\$62.14
4	80	\$35.72	\$7.80	\$20.85	\$0.00	\$64.37
5	85	\$37.95	\$7.80	\$20.85	\$0.00	\$66.60
6	90	\$40.19	\$7.80	\$20.85	\$0.00	\$68.84

Notes:

** Structural 1:6; Ornamental 1:4

Apprentice to Journeyworker Ratio:**

JACKHAMMER & PAVING BREAKER OPERATOR <i>LABORERS - ZONE 2</i>	06/01/2018	\$33.50	\$7.70	\$14.02	\$0.00	\$55.22
	12/01/2018	\$34.34	\$7.70	\$14.02	\$0.00	\$56.06
	06/01/2019	\$35.21	\$7.70	\$14.02	\$0.00	\$56.93
	12/01/2019	\$36.07	\$7.70	\$14.02	\$0.00	\$57.79
	06/01/2020	\$36.96	\$7.70	\$14.02	\$0.00	\$58.68
	12/01/2020	\$37.85	\$7.70	\$14.02	\$0.00	\$59.57
	06/01/2021	\$38.77	\$7.70	\$14.02	\$0.00	\$60.49
	12/01/2021	\$39.68	\$7.70	\$14.02	\$0.00	\$61.40

For apprentice rates see "Apprentice- LABORER"

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
LABORER LABORERS - ZONE 2	06/01/2018	\$33.25	\$7.70	\$14.02	\$0.00	\$54.97
	12/01/2018	\$34.09	\$7.70	\$14.02	\$0.00	\$55.81
	06/01/2019	\$34.96	\$7.70	\$14.02	\$0.00	\$56.68
	12/01/2019	\$35.82	\$7.70	\$14.02	\$0.00	\$57.54
	06/01/2020	\$36.71	\$7.70	\$14.02	\$0.00	\$58.43
	12/01/2020	\$37.60	\$7.70	\$14.02	\$0.00	\$59.32
	06/01/2021	\$38.52	\$7.70	\$14.02	\$0.00	\$60.24
	12/01/2021	\$39.43	\$7.70	\$14.02	\$0.00	\$61.15

Apprentice - LABORER - Zone 2

Effective Date - 06/01/2018

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	60	\$19.95	\$7.70	\$14.02	\$0.00	\$41.67
2	70	\$23.28	\$7.70	\$14.02	\$0.00	\$45.00
3	80	\$26.60	\$7.70	\$14.02	\$0.00	\$48.32
4	90	\$29.93	\$7.70	\$14.02	\$0.00	\$51.65

Effective Date - 12/01/2018

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	60	\$20.45	\$7.70	\$14.02	\$0.00	\$42.17
2	70	\$23.86	\$7.70	\$14.02	\$0.00	\$45.58
3	80	\$27.27	\$7.70	\$14.02	\$0.00	\$48.99
4	90	\$30.68	\$7.70	\$14.02	\$0.00	\$52.40

Notes:

Apprentice to Journeyworker Ratio:1:5

LABORER: CARPENTER TENDER LABORERS - ZONE 2	06/01/2018	\$33.25	\$7.70	\$14.02	\$0.00	\$54.97
	12/01/2018	\$34.09	\$7.70	\$14.02	\$0.00	\$55.81
	06/01/2019	\$34.96	\$7.70	\$14.02	\$0.00	\$56.68
	12/01/2019	\$35.82	\$7.70	\$14.02	\$0.00	\$57.54
	06/01/2020	\$36.71	\$7.70	\$14.02	\$0.00	\$58.43
	12/01/2020	\$37.60	\$7.70	\$14.02	\$0.00	\$59.32
	06/01/2021	\$38.52	\$7.70	\$14.02	\$0.00	\$60.24
	12/01/2021	\$39.43	\$7.70	\$14.02	\$0.00	\$61.15

For apprentice rates see "Apprentice- LABORER"

LABORER: CEMENT FINISHER TENDER LABORERS - ZONE 2	06/01/2018	\$33.25	\$7.70	\$14.02	\$0.00	\$54.97
	12/01/2018	\$34.09	\$7.70	\$14.02	\$0.00	\$55.81
	06/01/2019	\$34.96	\$7.70	\$14.02	\$0.00	\$56.68
	12/01/2019	\$35.82	\$7.70	\$14.02	\$0.00	\$57.54
	06/01/2020	\$36.71	\$7.70	\$14.02	\$0.00	\$58.43
	12/01/2020	\$37.60	\$7.70	\$14.02	\$0.00	\$59.32
	06/01/2021	\$38.52	\$7.70	\$14.02	\$0.00	\$60.24
	12/01/2021	\$39.43	\$7.70	\$14.02	\$0.00	\$61.15

For apprentice rates see "Apprentice- LABORER"

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
LABORER: HAZARDOUS WASTE/ASBESTOS REMOVER <i>LABORERS - ZONE 2</i>	06/01/2018	\$33.45	\$7.70	\$13.97	\$0.00	\$55.12
	12/01/2018	\$34.29	\$7.70	\$13.97	\$0.00	\$55.96
	06/01/2019	\$35.16	\$7.70	\$13.97	\$0.00	\$56.83
	12/01/2019	\$36.02	\$7.70	\$13.97	\$0.00	\$57.69
For apprentice rates see "Apprentice- LABORER"						
LABORER: MASON TENDER <i>LABORERS - ZONE 2</i>	06/01/2018	\$33.50	\$7.70	\$14.02	\$0.00	\$55.22
	12/01/2018	\$34.34	\$7.70	\$14.02	\$0.00	\$56.06
	06/01/2019	\$35.21	\$7.70	\$14.02	\$0.00	\$56.93
	12/01/2019	\$36.07	\$7.70	\$14.02	\$0.00	\$57.79
	06/01/2020	\$36.96	\$7.70	\$14.02	\$0.00	\$58.68
	12/01/2020	\$37.85	\$7.70	\$14.02	\$0.00	\$59.57
	06/01/2021	\$38.77	\$7.70	\$14.02	\$0.00	\$60.49
12/01/2021	\$39.68	\$7.70	\$14.02	\$0.00	\$61.40	
For apprentice rates see "Apprentice- LABORER"						
LABORER: MULTI-TRADE TENDER <i>LABORERS - ZONE 2</i>	06/01/2018	\$33.25	\$7.70	\$14.02	\$0.00	\$54.97
	12/01/2018	\$34.09	\$7.70	\$14.02	\$0.00	\$55.81
	06/01/2019	\$34.96	\$7.70	\$14.02	\$0.00	\$56.68
	12/01/2019	\$35.82	\$7.70	\$14.02	\$0.00	\$57.54
	06/01/2020	\$36.71	\$7.70	\$14.02	\$0.00	\$58.43
	12/01/2020	\$37.60	\$7.70	\$14.02	\$0.00	\$59.32
	06/01/2021	\$38.52	\$7.70	\$14.02	\$0.00	\$60.24
12/01/2021	\$39.43	\$7.70	\$14.02	\$0.00	\$61.15	
For apprentice rates see "Apprentice- LABORER"						
LABORER: TREE REMOVER <i>LABORERS - ZONE 2</i>	06/01/2018	\$33.25	\$7.70	\$14.02	\$0.00	\$54.97
	12/01/2018	\$34.09	\$7.70	\$14.02	\$0.00	\$55.81
	06/01/2019	\$34.96	\$7.70	\$14.02	\$0.00	\$56.68
	12/01/2019	\$35.82	\$7.70	\$14.02	\$0.00	\$57.54
	06/01/2020	\$36.71	\$7.70	\$14.02	\$0.00	\$58.43
	12/01/2020	\$37.60	\$7.70	\$14.02	\$0.00	\$59.32
	06/01/2021	\$38.52	\$7.70	\$14.02	\$0.00	\$60.24
12/01/2021	\$39.43	\$7.70	\$14.02	\$0.00	\$61.15	
This classification applies to all tree work associated with the removal of standing trees, and trimming and removal of branches and limbs when the work is not done for a utility company for the purpose of operation, maintenance or repair of utility company equipment. For apprentice rates see "Apprentice- LABORER"						
LASER BEAM OPERATOR <i>LABORERS - ZONE 2</i>	06/01/2018	\$33.50	\$7.70	\$14.02	\$0.00	\$55.22
	12/01/2018	\$34.34	\$7.70	\$14.02	\$0.00	\$56.06
	06/01/2019	\$35.21	\$7.70	\$14.02	\$0.00	\$56.93
	12/01/2019	\$36.07	\$7.70	\$14.02	\$0.00	\$57.79
	06/01/2020	\$36.96	\$7.70	\$14.02	\$0.00	\$58.68
	12/01/2020	\$37.85	\$7.70	\$14.02	\$0.00	\$59.57
	06/01/2021	\$38.77	\$7.70	\$14.02	\$0.00	\$60.49
12/01/2021	\$39.68	\$7.70	\$14.02	\$0.00	\$61.40	
For apprentice rates see "Apprentice- LABORER"						

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
MARBLE & TILE FINISHERS <i>BRICKLAYERS LOCAL 3 - MARBLE & TILE</i>	02/01/2018	\$39.82	\$10.75	\$18.34	\$0.00	\$68.91
	08/01/2018	\$40.40	\$10.75	\$18.97	\$0.00	\$70.12
	02/01/2019	\$40.91	\$10.75	\$18.97	\$0.00	\$70.63
	08/01/2019	\$41.99	\$10.75	\$19.11	\$0.00	\$71.85
	02/01/2020	\$42.50	\$10.75	\$19.11	\$0.00	\$72.36
	08/01/2020	\$43.58	\$10.75	\$19.26	\$0.00	\$73.59
	02/01/2021	\$44.09	\$10.75	\$19.26	\$0.00	\$74.10
	08/01/2021	\$45.21	\$10.75	\$19.42	\$0.00	\$75.38
	02/01/2022	\$45.68	\$10.75	\$19.42	\$0.00	\$75.85

Apprentice - MARBLE & TILE FINISHER - Local 3 Marble & Tile

Effective Date - 02/01/2018

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$19.91	\$10.75	\$18.34	\$0.00	\$49.00
2	60	\$23.89	\$10.75	\$18.34	\$0.00	\$52.98
3	70	\$27.87	\$10.75	\$18.34	\$0.00	\$56.96
4	80	\$31.86	\$10.75	\$18.34	\$0.00	\$60.95
5	90	\$35.84	\$10.75	\$18.34	\$0.00	\$64.93

Effective Date - 08/01/2018

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$20.20	\$10.75	\$18.97	\$0.00	\$49.92
2	60	\$24.24	\$10.75	\$18.97	\$0.00	\$53.96
3	70	\$28.28	\$10.75	\$18.97	\$0.00	\$58.00
4	80	\$32.32	\$10.75	\$18.97	\$0.00	\$62.04
5	90	\$36.36	\$10.75	\$18.97	\$0.00	\$66.08

Notes:

Apprentice to Journeyworker Ratio:1:3

MARBLE MASONS, TILELAYERS & TERRAZZO MECH <i>BRICKLAYERS LOCAL 3 - MARBLE & TILE</i>	02/01/2018	\$52.10	\$10.75	\$20.03	\$0.00	\$82.88
	08/01/2018	\$52.95	\$10.75	\$20.66	\$0.00	\$84.36
	02/01/2019	\$53.57	\$10.75	\$20.66	\$0.00	\$84.98
	08/01/2019	\$54.92	\$10.75	\$20.80	\$0.00	\$86.47
	02/01/2020	\$55.55	\$10.75	\$20.80	\$0.00	\$87.10
	08/01/2020	\$56.90	\$10.75	\$20.95	\$0.00	\$88.60
	02/01/2021	\$57.54	\$10.75	\$20.95	\$0.00	\$89.24
	08/01/2021	\$58.94	\$10.75	\$21.11	\$0.00	\$90.80
	02/01/2022	\$59.51	\$10.75	\$21.11	\$0.00	\$91.37

Classification

Effective Date Base Wage Health Pension Supplemental Unemployment Total Rate

Apprentice - MARBLE-TILE-TERRAZZO MECHANIC - Local 3 Marble & Tile

Effective Date - 02/01/2018

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$26.05	\$10.75	\$20.03	\$0.00	\$56.83
2	60	\$31.26	\$10.75	\$20.03	\$0.00	\$62.04
3	70	\$36.47	\$10.75	\$20.03	\$0.00	\$67.25
4	80	\$41.68	\$10.75	\$20.03	\$0.00	\$72.46
5	90	\$46.89	\$10.75	\$20.03	\$0.00	\$77.67

Effective Date - 08/01/2018

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$26.48	\$10.75	\$20.66	\$0.00	\$57.89
2	60	\$31.77	\$10.75	\$20.66	\$0.00	\$63.18
3	70	\$37.07	\$10.75	\$20.66	\$0.00	\$68.48
4	80	\$42.36	\$10.75	\$20.66	\$0.00	\$73.77
5	90	\$47.66	\$10.75	\$20.66	\$0.00	\$79.07

Notes:

Apprentice to Journeyworker Ratio:1:5

MECH. SWEEPER OPERATOR (ON CONST. SITES) OPERATING ENGINEERS LOCAL 4	12/01/2017	\$46.17	\$10.50	\$15.50	\$0.00	\$72.17
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For apprentice rates see "Apprentice- OPERATING ENGINEERS"

MECHANICS MAINTENANCE OPERATING ENGINEERS LOCAL 4	12/01/2017	\$46.17	\$10.50	\$15.50	\$0.00	\$72.17
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For apprentice rates see "Apprentice- OPERATING ENGINEERS"

MILLWRIGHT (Zone 2) MILLWRIGHTS LOCAL 1121 - Zone 2	04/01/2018	\$37.17	\$9.90	\$18.50	\$0.00	\$65.57
	10/01/2018	\$38.02	\$9.90	\$18.50	\$0.00	\$66.42
	04/01/2019	\$38.87	\$9.90	\$18.50	\$0.00	\$67.27

Apprentice - MILLWRIGHT - Local 1121 Zone 2

Effective Date - 04/01/2018

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	55	\$20.44	\$9.90	\$5.31	\$0.00	\$35.65
2	65	\$24.16	\$9.90	\$15.13	\$0.00	\$49.19
3	75	\$27.88	\$9.90	\$16.10	\$0.00	\$53.88
4	85	\$31.59	\$9.90	\$17.06	\$0.00	\$58.55

Notes:

Steps are 2,000 hours

Apprentice to Journeyworker Ratio:1:5

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
MORTAR MIXER <i>LABORERS - ZONE 2</i>	06/01/2018	\$33.50	\$7.70	\$14.02	\$0.00	\$55.22
	12/01/2018	\$34.34	\$7.70	\$14.02	\$0.00	\$56.06
	06/01/2019	\$35.21	\$7.70	\$14.02	\$0.00	\$56.93
	12/01/2019	\$36.07	\$7.70	\$14.02	\$0.00	\$57.79
	06/01/2020	\$36.96	\$7.70	\$14.02	\$0.00	\$58.68
	12/01/2020	\$37.85	\$7.70	\$14.02	\$0.00	\$59.57
	06/01/2021	\$38.77	\$7.70	\$14.02	\$0.00	\$60.49
	12/01/2021	\$39.68	\$7.70	\$14.02	\$0.00	\$61.40
For apprentice rates see "Apprentice- LABORER"						
OILER (OTHER THAN TRUCK CRANES,GRADALLS) <i>OPERATING ENGINEERS LOCAL 4</i>	12/01/2017	\$23.24	\$10.50	\$15.50	\$0.00	\$49.24
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
OILER (TRUCK CRANES, GRADALLS) <i>OPERATING ENGINEERS LOCAL 4</i>	12/01/2017	\$27.40	\$10.50	\$15.50	\$0.00	\$53.40
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
OTHER POWER DRIVEN EQUIPMENT - CLASS II <i>OPERATING ENGINEERS LOCAL 4</i>	12/01/2017	\$46.17	\$10.50	\$15.50	\$0.00	\$72.17
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
PAINTER (BRIDGES/TANKS) <i>PAINTERS LOCAL 35 - ZONE 2</i>	07/01/2018	\$50.01	\$8.15	\$20.15	\$0.00	\$78.31
	01/01/2019	\$50.36	\$8.15	\$20.85	\$0.00	\$79.36
	07/01/2019	\$51.46	\$8.15	\$20.85	\$0.00	\$80.46
	01/01/2020	\$52.56	\$8.15	\$20.85	\$0.00	\$81.56
	07/01/2020	\$53.66	\$8.15	\$20.85	\$0.00	\$82.66
	01/01/2021	\$54.76	\$8.15	\$20.85	\$0.00	\$83.76

Apprentice - PAINTER Local 35 - BRIDGES/TANKS

Effective Date - 07/01/2018

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$25.01	\$8.15	\$0.00	\$0.00	\$33.16
2	55	\$27.51	\$8.15	\$5.34	\$0.00	\$41.00
3	60	\$30.01	\$8.15	\$5.82	\$0.00	\$43.98
4	65	\$32.51	\$8.15	\$6.31	\$0.00	\$46.97
5	70	\$35.01	\$8.15	\$17.24	\$0.00	\$60.40
6	75	\$37.51	\$8.15	\$17.73	\$0.00	\$63.39
7	80	\$40.01	\$8.15	\$18.21	\$0.00	\$66.37
8	90	\$45.01	\$8.15	\$19.18	\$0.00	\$72.34

Effective Date - 01/01/2019

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$25.18	\$8.15	\$0.00	\$0.00	\$33.33
2	55	\$27.70	\$8.15	\$5.64	\$0.00	\$41.49
3	60	\$30.22	\$8.15	\$6.15	\$0.00	\$44.52
4	65	\$32.73	\$8.15	\$6.66	\$0.00	\$47.54
5	70	\$35.25	\$8.15	\$17.78	\$0.00	\$61.18
6	75	\$37.77	\$8.15	\$18.29	\$0.00	\$64.21
7	80	\$40.29	\$8.15	\$18.80	\$0.00	\$67.24
8	90	\$45.32	\$8.15	\$19.83	\$0.00	\$73.30

Notes:

Steps are 750 hrs.

Apprentice to Journeyworker Ratio:1:1

PAINTER (SPRAY OR SANDBLAST, NEW) *	07/01/2018	\$40.91	\$8.15	\$20.15	\$0.00	\$69.21
* If 30% or more of surfaces to be painted are new construction, NEW paint rate shall be used. PAINTERS LOCAL 35 - ZONE 2	01/01/2019	\$41.26	\$8.15	\$20.85	\$0.00	\$70.26
	07/01/2019	\$42.36	\$8.15	\$20.85	\$0.00	\$71.36
	01/01/2020	\$43.46	\$8.15	\$20.85	\$0.00	\$72.46
	07/01/2020	\$44.56	\$8.15	\$20.85	\$0.00	\$73.56
	01/01/2021	\$45.66	\$8.15	\$20.85	\$0.00	\$74.66

Classification

Effective Date Base Wage Health Pension Supplemental Unemployment Total Rate

Apprentice - PAINTER Local 35 Zone 2 - Spray/Sandblast - New

Effective Date - 07/01/2018

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$20.46	\$8.15	\$0.00	\$0.00	\$28.61
2	55	\$22.50	\$8.15	\$5.34	\$0.00	\$35.99
3	60	\$24.55	\$8.15	\$5.82	\$0.00	\$38.52
4	65	\$26.59	\$8.15	\$6.31	\$0.00	\$41.05
5	70	\$28.64	\$8.15	\$17.24	\$0.00	\$54.03
6	75	\$30.68	\$8.15	\$17.73	\$0.00	\$56.56
7	80	\$32.73	\$8.15	\$18.21	\$0.00	\$59.09
8	90	\$36.82	\$8.15	\$19.18	\$0.00	\$64.15

Effective Date - 01/01/2019

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$20.63	\$8.15	\$0.00	\$0.00	\$28.78
2	55	\$22.69	\$8.15	\$5.64	\$0.00	\$36.48
3	60	\$24.76	\$8.15	\$6.15	\$0.00	\$39.06
4	65	\$26.82	\$8.15	\$6.66	\$0.00	\$41.63
5	70	\$28.88	\$8.15	\$17.78	\$0.00	\$54.81
6	75	\$30.95	\$8.15	\$18.29	\$0.00	\$57.39
7	80	\$33.01	\$8.15	\$18.80	\$0.00	\$59.96
8	90	\$37.13	\$8.15	\$19.83	\$0.00	\$65.11

Notes:
Steps are 750 hrs.

Apprentice to Journeyworker Ratio:1:1

PAINTER (SPRAY OR SANDBLAST, REPAINT)	07/01/2018	\$38.97	\$8.15	\$20.15	\$0.00	\$67.27
PAINTERS LOCAL 35 - ZONE 2	01/01/2019	\$39.32	\$8.15	\$20.85	\$0.00	\$68.32
	07/01/2019	\$40.42	\$8.15	\$20.85	\$0.00	\$69.42
	01/01/2020	\$41.52	\$8.15	\$20.85	\$0.00	\$70.52
	07/01/2020	\$42.62	\$8.15	\$20.85	\$0.00	\$71.62
	01/01/2021	\$43.72	\$8.15	\$20.85	\$0.00	\$72.72

Classification

Effective Date Base Wage Health Pension Supplemental Unemployment Total Rate

Apprentice - PAINTER Local 35 Zone 2 - Spray/Sandblast - Repaint

Effective Date - 07/01/2018

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$19.49	\$8.15	\$0.00	\$0.00	\$27.64
2	55	\$21.43	\$8.15	\$5.34	\$0.00	\$34.92
3	60	\$23.38	\$8.15	\$5.82	\$0.00	\$37.35
4	65	\$25.33	\$8.15	\$6.31	\$0.00	\$39.79
5	70	\$27.28	\$8.15	\$17.24	\$0.00	\$52.67
6	75	\$29.23	\$8.15	\$17.73	\$0.00	\$55.11
7	80	\$31.18	\$8.15	\$18.21	\$0.00	\$57.54
8	90	\$35.07	\$8.15	\$19.18	\$0.00	\$62.40

Effective Date - 01/01/2019

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$19.66	\$8.15	\$0.00	\$0.00	\$27.81
2	55	\$21.63	\$8.15	\$5.64	\$0.00	\$35.42
3	60	\$23.59	\$8.15	\$6.15	\$0.00	\$37.89
4	65	\$25.56	\$8.15	\$6.66	\$0.00	\$40.37
5	70	\$27.52	\$8.15	\$17.78	\$0.00	\$53.45
6	75	\$29.49	\$8.15	\$18.29	\$0.00	\$55.93
7	80	\$31.46	\$8.15	\$18.80	\$0.00	\$58.41
8	90	\$35.39	\$8.15	\$19.83	\$0.00	\$63.37

Notes:

Steps are 750 hrs.

Apprentice to Journeyworker Ratio:1:1

PAINTER (TRAFFIC MARKINGS) LABORERS - ZONE 2	06/01/2018	\$33.25	\$7.70	\$14.02	\$0.00	\$54.97
	12/01/2018	\$34.09	\$7.70	\$14.02	\$0.00	\$55.81
	06/01/2019	\$34.96	\$7.70	\$14.02	\$0.00	\$56.68
	12/01/2019	\$35.82	\$7.70	\$14.02	\$0.00	\$57.54
	06/01/2020	\$36.71	\$7.70	\$14.02	\$0.00	\$58.43
	12/01/2020	\$37.60	\$7.70	\$14.02	\$0.00	\$59.32
	06/01/2021	\$38.52	\$7.70	\$14.02	\$0.00	\$60.24
	12/01/2021	\$39.43	\$7.70	\$14.02	\$0.00	\$61.15

For Apprentice rates see "Apprentice- LABORER"

PAINTER / TAPER (BRUSH, NEW) *	07/01/2018	\$39.51	\$8.15	\$20.15	\$0.00	\$67.81
* If 30% or more of surfaces to be painted are new construction, NEW paint rate shall be used. PAINTERS LOCAL 35 - ZONE 2	01/01/2019	\$39.86	\$8.15	\$20.85	\$0.00	\$68.86
	07/01/2019	\$40.96	\$8.15	\$20.85	\$0.00	\$69.96
	01/01/2020	\$42.06	\$8.15	\$20.85	\$0.00	\$71.06
	07/01/2020	\$43.16	\$8.15	\$20.85	\$0.00	\$72.16
	01/01/2021	\$44.25	\$8.15	\$20.85	\$0.00	\$73.25

Apprentice - PAINTER - Local 35 Zone 2 - BRUSH NEW

Effective Date - 07/01/2018

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$19.76	\$8.15	\$0.00	\$0.00	\$27.91
2	55	\$21.73	\$8.15	\$5.34	\$0.00	\$35.22
3	60	\$23.71	\$8.15	\$5.82	\$0.00	\$37.68
4	65	\$25.68	\$8.15	\$6.31	\$0.00	\$40.14
5	70	\$27.66	\$8.15	\$17.24	\$0.00	\$53.05
6	75	\$29.63	\$8.15	\$17.73	\$0.00	\$55.51
7	80	\$31.61	\$8.15	\$18.21	\$0.00	\$57.97
8	90	\$35.56	\$8.15	\$19.18	\$0.00	\$62.89

Effective Date - 01/01/2019

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$19.93	\$8.15	\$0.00	\$0.00	\$28.08
2	55	\$21.92	\$8.15	\$5.64	\$0.00	\$35.71
3	60	\$23.92	\$8.15	\$6.15	\$0.00	\$38.22
4	65	\$25.91	\$8.15	\$6.66	\$0.00	\$40.72
5	70	\$27.90	\$8.15	\$17.78	\$0.00	\$53.83
6	75	\$29.90	\$8.15	\$18.29	\$0.00	\$56.34
7	80	\$31.89	\$8.15	\$18.80	\$0.00	\$58.84
8	90	\$35.87	\$8.15	\$19.83	\$0.00	\$63.85

Notes:

Steps are 750 hrs.

Apprentice to Journeyworker Ratio:1:1

PAINTER / TAPER (BRUSH, REPAINT)	07/01/2018	\$37.57	\$8.15	\$20.15	\$0.00	\$65.87
PAINTERS LOCAL 35 - ZONE 2	01/01/2019	\$37.92	\$8.15	\$20.85	\$0.00	\$66.92
	07/01/2019	\$39.02	\$8.15	\$20.85	\$0.00	\$68.02
	01/01/2020	\$40.12	\$8.15	\$20.85	\$0.00	\$69.12
	07/01/2020	\$41.22	\$8.15	\$20.85	\$0.00	\$70.22
	01/01/2021	\$42.32	\$8.15	\$20.85	\$0.00	\$71.32

Classification

Effective Date Base Wage Health Pension Supplemental Unemployment Total Rate

Apprentice - PAINTER Local 35 Zone 2 - BRUSH REPAINT

Effective Date - 07/01/2018

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$18.79	\$8.15	\$0.00	\$0.00	\$26.94
2	55	\$20.66	\$8.15	\$5.34	\$0.00	\$34.15
3	60	\$22.54	\$8.15	\$5.82	\$0.00	\$36.51
4	65	\$24.42	\$8.15	\$6.31	\$0.00	\$38.88
5	70	\$26.30	\$8.15	\$17.24	\$0.00	\$51.69
6	75	\$28.18	\$8.15	\$17.73	\$0.00	\$54.06
7	80	\$30.06	\$8.15	\$18.21	\$0.00	\$56.42
8	90	\$33.81	\$8.15	\$19.18	\$0.00	\$61.14

Effective Date - 01/01/2019

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$18.96	\$8.15	\$0.00	\$0.00	\$27.11
2	55	\$20.86	\$8.15	\$5.64	\$0.00	\$34.65
3	60	\$22.75	\$8.15	\$6.15	\$0.00	\$37.05
4	65	\$24.65	\$8.15	\$6.66	\$0.00	\$39.46
5	70	\$26.54	\$8.15	\$17.78	\$0.00	\$52.47
6	75	\$28.44	\$8.15	\$18.29	\$0.00	\$54.88
7	80	\$30.34	\$8.15	\$18.80	\$0.00	\$57.29
8	90	\$34.13	\$8.15	\$19.83	\$0.00	\$62.11

Notes:
Steps are 750 hrs.

Apprentice to Journeyworker Ratio:1:1

PANEL & PICKUP TRUCKS DRIVER <i>TEAMSTERS JOINT COUNCIL NO. 10 ZONE B</i>	12/01/2012	\$30.28	\$9.07	\$8.00	\$0.00	\$47.35
PIER AND DOCK CONSTRUCTOR (UNDERPINNING AND DECK) <i>PILE DRIVER LOCAL 56 (ZONE 1)</i>	08/01/2017	\$44.27	\$9.90	\$21.15	\$0.00	\$75.32
	08/01/2018	\$46.57	\$9.90	\$21.15	\$0.00	\$77.62
	08/01/2019	\$48.94	\$9.90	\$21.15	\$0.00	\$79.99
For apprentice rates see "Apprentice- PILE DRIVER"						
PILE DRIVER <i>PILE DRIVER LOCAL 56 (ZONE 1)</i>	08/01/2017	\$44.27	\$9.90	\$21.15	\$0.00	\$75.32
	08/01/2018	\$46.57	\$9.90	\$21.15	\$0.00	\$77.62
	08/01/2019	\$48.94	\$9.90	\$21.15	\$0.00	\$79.99

Classification

Effective Date Base Wage Health Pension Supplemental Unemployment Total Rate

Apprentice - PILE DRIVER - Local 56 Zone 1

Effective Date - 08/01/2017

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$22.14	\$9.90	\$21.15	\$0.00	\$53.19
2	60	\$26.56	\$9.90	\$21.15	\$0.00	\$57.61
3	70	\$30.99	\$9.90	\$21.15	\$0.00	\$62.04
4	75	\$33.20	\$9.90	\$21.15	\$0.00	\$64.25
5	80	\$35.42	\$9.90	\$21.15	\$0.00	\$66.47
6	80	\$35.42	\$9.90	\$21.15	\$0.00	\$66.47
7	90	\$39.84	\$9.90	\$21.15	\$0.00	\$70.89
8	90	\$39.84	\$9.90	\$21.15	\$0.00	\$70.89

Effective Date - 08/01/2018

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$23.29	\$9.90	\$21.15	\$0.00	\$54.34
2	60	\$27.94	\$9.90	\$21.15	\$0.00	\$58.99
3	70	\$32.60	\$9.90	\$21.15	\$0.00	\$63.65
4	75	\$34.93	\$9.90	\$21.15	\$0.00	\$65.98
5	80	\$37.26	\$9.90	\$21.15	\$0.00	\$68.31
6	80	\$37.26	\$9.90	\$21.15	\$0.00	\$68.31
7	90	\$41.91	\$9.90	\$21.15	\$0.00	\$72.96
8	90	\$41.91	\$9.90	\$21.15	\$0.00	\$72.96

Notes:

Apprentice to Journeyworker Ratio:1:5

PIPELAYER	06/01/2018	\$33.50	\$7.70	\$14.02	\$0.00	\$55.22
LABORERS - ZONE 2	12/01/2018	\$34.34	\$7.70	\$14.02	\$0.00	\$56.06
	06/01/2019	\$35.21	\$7.70	\$14.02	\$0.00	\$56.93
	12/01/2019	\$36.07	\$7.70	\$14.02	\$0.00	\$57.79
	06/01/2020	\$36.96	\$7.70	\$14.02	\$0.00	\$58.68
	12/01/2020	\$37.85	\$7.70	\$14.02	\$0.00	\$59.57
	06/01/2021	\$38.77	\$7.70	\$14.02	\$0.00	\$60.49
	12/01/2021	\$39.68	\$7.70	\$14.02	\$0.00	\$61.40

For apprentice rates see "Apprentice- LABORER"

PLUMBER & PIPEFITTER	09/01/2017	\$40.69	\$10.00	\$17.60	\$0.00	\$68.29
PLUMBERS & PIPEFITTERS LOCAL 51	09/01/2018	\$42.69	\$10.00	\$17.60	\$0.00	\$70.29

Classification

Effective Date Base Wage Health Pension Supplemental Unemployment Total Rate

Apprentice - PLUMBER/PIPEFITTER - Local 51

Effective Date - 09/01/2017

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	40	\$16.28	\$10.00	\$2.50	\$0.00	\$28.78
2	50	\$20.35	\$10.00	\$2.50	\$0.00	\$32.85
3	60	\$24.41	\$10.00	\$7.60	\$0.00	\$42.01
4	70	\$28.48	\$10.00	\$12.16	\$0.00	\$50.64
5	80	\$32.55	\$10.00	\$15.70	\$0.00	\$58.25

Effective Date - 09/01/2018

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	40	\$17.08	\$10.00	\$2.50	\$0.00	\$29.58
2	50	\$21.35	\$10.00	\$2.50	\$0.00	\$33.85
3	60	\$25.61	\$10.00	\$7.60	\$0.00	\$43.21
4	70	\$29.88	\$10.00	\$12.16	\$0.00	\$52.04
5	80	\$34.15	\$10.00	\$15.70	\$0.00	\$59.85

Notes:

Steps 2000hrs. Prior 9/1/05; 40/40/45/50/55/60/65/75/80/85

Apprentice to Journeyworker Ratio:1:3

PNEUMATIC CONTROLS (TEMP.) PLUMBERS & PIPEFITTERS LOCAL 51	09/01/2017	\$40.69	\$10.00	\$17.60	\$0.00	\$68.29
	09/01/2018	\$42.69	\$10.00	\$17.60	\$0.00	\$70.29

For apprentice rates see "Apprentice- PIPEFITTER" or "PLUMBER/PIPEFITTER"

PNEUMATIC DRILL/TOOL OPERATOR LABORERS - ZONE 2	06/01/2018	\$33.50	\$7.70	\$14.02	\$0.00	\$55.22
	12/01/2018	\$34.34	\$7.70	\$14.02	\$0.00	\$56.06
	06/01/2019	\$35.21	\$7.70	\$14.02	\$0.00	\$56.93
	12/01/2019	\$36.07	\$7.70	\$14.02	\$0.00	\$57.79
	06/01/2020	\$36.96	\$7.70	\$14.02	\$0.00	\$58.68
	12/01/2020	\$37.85	\$7.70	\$14.02	\$0.00	\$59.57
	06/01/2021	\$38.77	\$7.70	\$14.02	\$0.00	\$60.49
	12/01/2021	\$39.68	\$7.70	\$14.02	\$0.00	\$61.40

For apprentice rates see "Apprentice- LABORER"

POWDERMAN & BLASTER LABORERS - ZONE 2	06/01/2018	\$34.25	\$7.70	\$14.02	\$0.00	\$55.97
	12/01/2018	\$35.09	\$7.70	\$14.02	\$0.00	\$56.81
	06/01/2019	\$35.96	\$7.70	\$14.02	\$0.00	\$57.68
	12/01/2019	\$36.82	\$7.70	\$14.02	\$0.00	\$58.54
	06/01/2020	\$37.71	\$7.70	\$14.02	\$0.00	\$59.43
	12/01/2020	\$38.60	\$7.70	\$14.02	\$0.00	\$60.32
	06/01/2021	\$39.52	\$7.70	\$14.02	\$0.00	\$61.24
	12/01/2021	\$40.43	\$7.70	\$14.02	\$0.00	\$62.15

For apprentice rates see "Apprentice- LABORER"

POWER SHOVEL/DERRICK/TRENCHING MACHINE OPERATING ENGINEERS LOCAL 4	12/01/2017	\$46.63	\$10.50	\$15.50	\$0.00	\$72.63
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For apprentice rates see "Apprentice- OPERATING ENGINEERS"

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
PUMP OPERATOR (CONCRETE) <i>OPERATING ENGINEERS LOCAL 4</i>	12/01/2017	\$46.63	\$10.50	\$15.50	\$0.00	\$72.63
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
PUMP OPERATOR (DEWATERING, OTHER) <i>OPERATING ENGINEERS LOCAL 4</i>	12/01/2017	\$31.80	\$10.50	\$15.50	\$0.00	\$57.80
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
READY-MIX CONCRETE DRIVER <i>TEAMSTERS LOCAL 653</i>	08/01/2008	\$19.76	\$7.16	\$4.21	\$0.00	\$31.13
RECLAIMERS <i>OPERATING ENGINEERS LOCAL 4</i>	12/01/2017	\$46.17	\$10.50	\$15.50	\$0.00	\$72.17
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
RIDE-ON MOTORIZED BUGGY OPERATOR <i>LABORERS - ZONE 2</i>	06/01/2018	\$33.50	\$7.70	\$14.02	\$0.00	\$55.22
	12/01/2018	\$34.34	\$7.70	\$14.02	\$0.00	\$56.06
	06/01/2019	\$35.21	\$7.70	\$14.02	\$0.00	\$56.93
	12/01/2019	\$36.07	\$7.70	\$14.02	\$0.00	\$57.79
	06/01/2020	\$36.96	\$7.70	\$14.02	\$0.00	\$58.68
	12/01/2020	\$37.85	\$7.70	\$14.02	\$0.00	\$59.57
	06/01/2021	\$38.77	\$7.70	\$14.02	\$0.00	\$60.49
	12/01/2021	\$39.68	\$7.70	\$14.02	\$0.00	\$61.40
For apprentice rates see "Apprentice- LABORER"						
ROLLER/SPREADER/MULCHING MACHINE <i>OPERATING ENGINEERS LOCAL 4</i>	12/01/2017	\$46.17	\$10.50	\$15.50	\$0.00	\$72.17
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
ROOFER (Inc.Roofing Waterproofing &Roofing Damproofg) <i>ROOFERS LOCAL 33</i>	02/01/2018	\$42.36	\$11.35	\$14.80	\$0.00	\$68.51
	08/01/2018	\$43.46	\$11.35	\$14.80	\$0.00	\$69.61
	02/01/2019	\$44.61	\$11.35	\$14.80	\$0.00	\$70.76

Apprentice - ROOFER - Local 33

Effective Date - 02/01/2018

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$21.18	\$11.35	\$3.44	\$0.00	\$35.97
2	60	\$25.42	\$11.35	\$14.80	\$0.00	\$51.57
3	65	\$27.53	\$11.35	\$14.80	\$0.00	\$53.68
4	75	\$31.77	\$11.35	\$14.80	\$0.00	\$57.92
5	85	\$36.01	\$11.35	\$14.80	\$0.00	\$62.16

Effective Date - 08/01/2018

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$21.73	\$11.35	\$3.44	\$0.00	\$36.52
2	60	\$26.08	\$11.35	\$14.80	\$0.00	\$52.23
3	65	\$28.25	\$11.35	\$14.80	\$0.00	\$54.40
4	75	\$32.60	\$11.35	\$14.80	\$0.00	\$58.75
5	85	\$36.94	\$11.35	\$14.80	\$0.00	\$63.09

Notes: ** 1:5, 2:6-10, the 1:10; Reroofing: 1:4, then 1:1
 Step 1 is 2000 hrs.; Steps 2-5 are 1000 hrs.
 (Hot Pitch Mechanics' receive \$1.00 hr. above ROOFER)

Apprentice to Journeyworker Ratio:**

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
ROOFER SLATE / TILE / PRECAST CONCRETE <i>ROOFERS LOCAL 33</i>	02/01/2018	\$42.61	\$11.35	\$14.80	\$0.00	\$68.76
	08/01/2018	\$43.71	\$11.35	\$14.80	\$0.00	\$69.86
	02/01/2019	\$44.86	\$11.35	\$14.80	\$0.00	\$71.01
For apprentice rates see "Apprentice- ROOFER"						
SHEETMETAL WORKER <i>SHEETMETAL WORKERS LOCAL 17 - A</i>	02/01/2018	\$44.11	\$12.20	\$24.12	\$2.41	\$82.84

Apprentice - SHEET METAL WORKER - Local 17-A

Effective Date - 02/01/2018

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	40	\$17.64	\$12.20	\$5.61	\$0.00	\$35.45
2	40	\$17.64	\$12.20	\$5.61	\$0.00	\$35.45
3	45	\$19.85	\$12.20	\$10.85	\$1.29	\$44.19
4	45	\$19.85	\$12.20	\$10.85	\$1.29	\$44.19
5	50	\$22.06	\$12.20	\$11.80	\$1.38	\$47.44
6	50	\$22.06	\$12.20	\$12.05	\$1.39	\$47.70
7	60	\$26.47	\$12.20	\$13.70	\$1.57	\$53.94
8	65	\$28.67	\$12.20	\$14.65	\$1.67	\$57.19
9	75	\$33.08	\$12.20	\$16.56	\$1.86	\$63.70
10	85	\$37.49	\$12.20	\$17.96	\$2.03	\$69.68

Notes:

Steps are 6 mos.

Apprentice to Journeyworker Ratio:1:4

SIGN ERECTOR <i>PAINTERS LOCAL 35 - ZONE 2</i>	06/01/2013	\$25.81	\$7.07	\$7.05	\$0.00	\$39.93
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Apprentice - SIGN ERECTOR - Local 35 Zone 2

Effective Date - 06/01/2013

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$12.91	\$7.07	\$0.00	\$0.00	\$19.98
2	55	\$14.20	\$7.07	\$2.45	\$0.00	\$23.72
3	60	\$15.49	\$7.07	\$2.45	\$0.00	\$25.01
4	65	\$16.78	\$7.07	\$2.45	\$0.00	\$26.30
5	70	\$18.07	\$7.07	\$7.05	\$0.00	\$32.19
6	75	\$19.36	\$7.07	\$7.05	\$0.00	\$33.48
7	80	\$20.65	\$7.07	\$7.05	\$0.00	\$34.77
8	85	\$21.94	\$7.07	\$7.05	\$0.00	\$36.06
9	90	\$23.23	\$7.07	\$7.05	\$0.00	\$37.35

Notes:

Steps are 4 mos.

Apprentice to Journeyworker Ratio:1:1

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
SPECIALIZED EARTH MOVING EQUIP < 35 TONS <i>TEAMSTERS JOINT COUNCIL NO. 10 ZONE B</i>	12/01/2016	\$32.44	\$10.91	\$10.89	\$0.00	\$54.24
SPECIALIZED EARTH MOVING EQUIP > 35 TONS <i>TEAMSTERS JOINT COUNCIL NO. 10 ZONE B</i>	12/01/2016	\$32.73	\$10.91	\$10.89	\$0.00	\$54.53
SPRINKLER FITTER <i>SPRINKLER FITTERS LOCAL 550 - (Section A) Zone 1</i>	03/01/2018	\$57.78	\$9.12	\$18.15	\$0.00	\$85.05
	10/01/2018	\$59.28	\$9.12	\$18.15	\$0.00	\$86.55
	01/01/2019	\$59.28	\$9.47	\$18.35	\$0.00	\$87.10
	03/01/2019	\$60.78	\$9.47	\$18.35	\$0.00	\$88.60
	10/01/2019	\$62.28	\$9.47	\$18.35	\$0.00	\$90.10
	03/01/2020	\$63.78	\$9.47	\$18.35	\$0.00	\$91.60
	10/01/2020	\$65.28	\$9.47	\$18.35	\$0.00	\$93.10
	03/01/2021	\$66.78	\$9.47	\$18.35	\$0.00	\$94.60

Apprentice - SPRINKLER FITTER - Local 550 (Section A) Zone 1

Effective Date - 03/01/2018

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	35	\$20.22	\$9.12	\$8.90	\$0.00	\$38.24
2	40	\$23.11	\$9.12	\$8.90	\$0.00	\$41.13
3	45	\$26.00	\$9.12	\$8.90	\$0.00	\$44.02
4	50	\$28.89	\$9.12	\$8.90	\$0.00	\$46.91
5	55	\$31.78	\$9.12	\$8.90	\$0.00	\$49.80
6	60	\$34.67	\$9.12	\$10.40	\$0.00	\$54.19
7	65	\$37.56	\$9.12	\$10.40	\$0.00	\$57.08
8	70	\$40.45	\$9.12	\$10.40	\$0.00	\$59.97
9	75	\$43.34	\$9.12	\$10.40	\$0.00	\$62.86
10	80	\$46.22	\$9.12	\$10.40	\$0.00	\$65.74

Effective Date - 10/01/2018

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	35	\$20.75	\$9.12	\$8.90	\$0.00	\$38.77
2	40	\$23.71	\$9.12	\$8.90	\$0.00	\$41.73
3	45	\$26.68	\$9.12	\$8.90	\$0.00	\$44.70
4	50	\$29.64	\$9.12	\$8.90	\$0.00	\$47.66
5	55	\$32.60	\$9.12	\$8.90	\$0.00	\$50.62
6	60	\$35.57	\$9.12	\$10.40	\$0.00	\$55.09
7	65	\$38.53	\$9.12	\$10.40	\$0.00	\$58.05
8	70	\$41.50	\$9.12	\$10.40	\$0.00	\$61.02
9	75	\$44.46	\$9.12	\$10.40	\$0.00	\$63.98
10	80	\$47.42	\$9.12	\$10.40	\$0.00	\$66.94

Notes: Apprentice entered prior 9/30/10:
40/45/50/55/60/65/70/75/80/85
Steps are 850 hours

Apprentice to Journeyworker Ratio:1:3

STEAM BOILER OPERATOR <i>OPERATING ENGINEERS LOCAL 4</i>	12/01/2017	\$46.17	\$10.50	\$15.50	\$0.00	\$72.17
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Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
TAMPERS, SELF-PROPELLED OR TRACTOR DRAWN OPERATING ENGINEERS LOCAL 4	12/01/2017	\$46.17	\$10.50	\$15.50	\$0.00	\$72.17
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
TELECOMMUNICATION TECHNICIAN ELECTRICIANS LOCAL 223	03/01/2018	\$34.27	\$9.40	\$10.46	\$0.00	\$54.13
	09/01/2018	\$34.76	\$9.65	\$10.81	\$0.00	\$55.22
	03/01/2019	\$35.25	\$9.90	\$11.14	\$0.00	\$56.29
	09/01/2019	\$35.78	\$10.15	\$11.45	\$0.00	\$57.38
	03/01/2020	\$36.27	\$10.40	\$11.78	\$0.00	\$58.45

Apprentice - TELECOMMUNICATION TECHNICIAN - Local 223

Effective Date - 03/01/2018

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	0	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00

Notes: See Electrician Apprentice Wages
Steps are 750hrs
Telecom Apprentice Wages shall be the same as the Electrician Apprentice Wages

Apprentice to Journeyworker Ratio:2:3***

TERRAZZO FINISHERS BRICKLAYERS LOCAL 3 - MARBLE & TILE	02/01/2018	\$51.00	\$10.75	\$20.03	\$0.00	\$81.78
	08/01/2018	\$51.85	\$10.75	\$20.66	\$0.00	\$83.26
	02/01/2019	\$52.49	\$10.75	\$20.66	\$0.00	\$83.90
	08/01/2019	\$53.84	\$10.75	\$20.80	\$0.00	\$85.39
	02/01/2020	\$54.48	\$10.75	\$20.80	\$0.00	\$86.03
	08/01/2020	\$55.83	\$10.75	\$20.95	\$0.00	\$87.53
	02/01/2021	\$56.47	\$10.75	\$20.95	\$0.00	\$88.17
	08/01/2021	\$57.87	\$10.75	\$21.11	\$0.00	\$89.73
	02/01/2022	\$58.46	\$10.75	\$21.11	\$0.00	\$90.32

Classification

Effective Date Base Wage Health Pension Supplemental Unemployment Total Rate

Apprentice - TERRAZZO FINISHER - Local 3 Marble & Tile

Effective Date - 02/01/2018

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$25.50	\$10.75	\$20.03	\$0.00	\$56.28
2	60	\$30.60	\$10.75	\$20.03	\$0.00	\$61.38
3	70	\$35.70	\$10.75	\$20.03	\$0.00	\$66.48
4	80	\$40.80	\$10.75	\$20.03	\$0.00	\$71.58
5	90	\$45.90	\$10.75	\$20.03	\$0.00	\$76.68

Effective Date - 08/01/2018

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$25.93	\$10.75	\$20.03	\$0.00	\$56.71
2	60	\$31.11	\$10.75	\$20.03	\$0.00	\$61.89
3	70	\$36.30	\$10.75	\$20.03	\$0.00	\$67.08
4	80	\$41.48	\$10.75	\$20.03	\$0.00	\$72.26
5	90	\$46.67	\$10.75	\$20.03	\$0.00	\$77.45

Notes:

Apprentice to Journeyworker Ratio:1:3

TEST BORING DRILLER <i>LABORERS - FOUNDATION AND MARINE</i>	06/01/2018	\$39.35	\$7.70	\$15.40	\$0.00	\$62.45
	12/01/2018	\$40.30	\$7.70	\$15.40	\$0.00	\$63.40
	06/01/2019	\$41.30	\$7.70	\$15.40	\$0.00	\$64.40
	12/01/2019	\$42.30	\$7.70	\$15.40	\$0.00	\$65.40
	06/01/2020	\$43.29	\$7.70	\$15.40	\$0.00	\$66.39
	12/01/2020	\$44.27	\$7.70	\$15.40	\$0.00	\$67.37
	06/01/2021	\$45.29	\$7.70	\$15.40	\$0.00	\$68.39
	12/01/2021	\$46.30	\$7.70	\$15.40	\$0.00	\$69.40

For apprentice rates see "Apprentice- LABORER"

TEST BORING DRILLER HELPER <i>LABORERS - FOUNDATION AND MARINE</i>	06/01/2018	\$38.07	\$7.70	\$15.40	\$0.00	\$61.17
	12/01/2018	\$39.02	\$7.70	\$15.40	\$0.00	\$62.12
	06/01/2019	\$40.02	\$7.70	\$15.40	\$0.00	\$63.12
	12/01/2019	\$41.02	\$7.70	\$15.40	\$0.00	\$64.12
	06/01/2020	\$42.01	\$7.70	\$15.40	\$0.00	\$65.11
	12/01/2020	\$42.99	\$7.70	\$15.40	\$0.00	\$66.09
	06/01/2021	\$44.01	\$7.70	\$15.40	\$0.00	\$67.11
	12/01/2021	\$45.02	\$7.70	\$15.40	\$0.00	\$68.12

For apprentice rates see "Apprentice- LABORER"

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
TEST BORING LABORER <i>LABORERS - FOUNDATION AND MARINE</i>	06/01/2018	\$37.95	\$7.70	\$15.40	\$0.00	\$61.05
	12/01/2018	\$38.90	\$7.70	\$15.40	\$0.00	\$62.00
	06/01/2019	\$39.90	\$7.70	\$15.40	\$0.00	\$63.00
	12/01/2019	\$40.90	\$7.70	\$15.40	\$0.00	\$64.00
	06/01/2020	\$41.89	\$7.70	\$15.40	\$0.00	\$64.99
	12/01/2020	\$42.87	\$7.70	\$15.40	\$0.00	\$65.97
	06/01/2021	\$43.89	\$7.70	\$15.40	\$0.00	\$66.99
	12/01/2021	\$44.90	\$7.70	\$15.40	\$0.00	\$68.00
For apprentice rates see "Apprentice- LABORER"						
TRACTORS/PORTABLE STEAM GENERATORS <i>OPERATING ENGINEERS LOCAL 4</i>	12/01/2017	\$46.17	\$10.50	\$15.50	\$0.00	\$72.17
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
TRAILERS FOR EARTH MOVING EQUIPMENT <i>TEAMSTERS JOINT COUNCIL NO. 10 ZONE B</i>	12/01/2016	\$33.02	\$10.91	\$10.89	\$0.00	\$54.82
TUNNEL WORK - COMPRESSED AIR <i>LABORERS (COMPRESSED AIR)</i>	06/01/2018	\$50.23	\$7.70	\$15.80	\$0.00	\$73.73
	12/01/2018	\$51.18	\$7.70	\$15.80	\$0.00	\$74.68
	06/01/2019	\$52.18	\$7.70	\$15.80	\$0.00	\$75.68
	12/01/2019	\$53.18	\$7.70	\$15.80	\$0.00	\$76.68
	06/01/2020	\$54.17	\$7.70	\$15.80	\$0.00	\$77.67
	12/01/2020	\$55.15	\$7.70	\$15.80	\$0.00	\$78.65
	06/01/2021	\$56.17	\$7.70	\$15.80	\$0.00	\$79.67
	12/01/2021	\$57.18	\$7.70	\$15.80	\$0.00	\$80.68
For apprentice rates see "Apprentice- LABORER"						
TUNNEL WORK - COMPRESSED AIR (HAZ. WASTE) <i>LABORERS (COMPRESSED AIR)</i>	06/01/2018	\$52.23	\$7.70	\$15.80	\$0.00	\$75.73
	12/01/2018	\$53.18	\$7.70	\$15.80	\$0.00	\$76.68
	06/01/2019	\$54.18	\$7.70	\$15.80	\$0.00	\$77.68
	12/01/2019	\$55.18	\$7.70	\$15.80	\$0.00	\$78.68
	06/01/2020	\$56.17	\$7.70	\$15.80	\$0.00	\$79.67
	12/01/2020	\$57.15	\$7.70	\$15.80	\$0.00	\$80.65
	06/01/2021	\$58.17	\$7.70	\$15.80	\$0.00	\$81.67
	12/01/2021	\$59.18	\$7.70	\$15.80	\$0.00	\$82.68
For apprentice rates see "Apprentice- LABORER"						
TUNNEL WORK - FREE AIR <i>LABORERS (FREE AIR TUNNEL)</i>	06/01/2018	\$42.30	\$7.70	\$15.80	\$0.00	\$65.80
	12/01/2018	\$43.25	\$7.70	\$15.80	\$0.00	\$66.75
	06/01/2019	\$44.25	\$7.70	\$15.80	\$0.00	\$67.75
	12/01/2019	\$45.25	\$7.70	\$15.80	\$0.00	\$68.75
	06/01/2020	\$46.24	\$7.70	\$15.80	\$0.00	\$69.74
	12/01/2020	\$47.22	\$7.70	\$15.80	\$0.00	\$70.72
	06/01/2021	\$48.24	\$7.70	\$15.80	\$0.00	\$71.74
	12/01/2021	\$49.25	\$7.70	\$15.80	\$0.00	\$72.75
For apprentice rates see "Apprentice- LABORER"						

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
TUNNEL WORK - FREE AIR (HAZ. WASTE) <i>LABORERS (FREE AIR TUNNEL)</i>	06/01/2018	\$44.30	\$7.70	\$15.80	\$0.00	\$67.80
	12/01/2018	\$45.25	\$7.70	\$15.80	\$0.00	\$68.75
	06/01/2019	\$46.25	\$7.70	\$15.80	\$0.00	\$69.75
	12/01/2019	\$47.25	\$7.70	\$15.80	\$0.00	\$70.75
	06/01/2020	\$48.24	\$7.70	\$15.80	\$0.00	\$71.74
	12/01/2020	\$49.22	\$7.70	\$15.80	\$0.00	\$72.72
	06/01/2021	\$50.24	\$7.70	\$15.80	\$0.00	\$73.74
	12/01/2021	\$51.25	\$7.70	\$15.80	\$0.00	\$74.75
For apprentice rates see "Apprentice- LABORER"						
VAC-HAUL <i>TEAMSTERS JOINT COUNCIL NO. 10 ZONE B</i>	12/01/2016	\$32.44	\$10.91	\$10.89	\$0.00	\$54.24
WAGON DRILL OPERATOR <i>LABORERS - ZONE 2</i>	06/01/2018	\$33.50	\$7.70	\$14.02	\$0.00	\$55.22
	12/01/2018	\$34.34	\$7.70	\$14.02	\$0.00	\$56.06
	06/01/2019	\$35.21	\$7.70	\$14.02	\$0.00	\$56.93
	12/01/2019	\$36.07	\$7.70	\$14.02	\$0.00	\$57.79
	06/01/2020	\$36.96	\$7.70	\$14.02	\$0.00	\$58.68
	12/01/2020	\$37.85	\$7.70	\$14.02	\$0.00	\$59.57
	06/01/2021	\$38.77	\$7.70	\$14.02	\$0.00	\$60.49
	12/01/2021	\$39.68	\$7.70	\$14.02	\$0.00	\$61.40
For apprentice rates see "Apprentice- LABORER"						
WASTE WATER PUMP OPERATOR <i>OPERATING ENGINEERS LOCAL 4</i>	12/01/2017	\$46.63	\$10.50	\$15.50	\$0.00	\$72.63
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
WATER METER INSTALLER <i>PLUMBERS & PIPEFITTERS LOCAL 51</i>	09/01/2017	\$40.69	\$10.00	\$17.60	\$0.00	\$68.29
	09/01/2018	\$42.69	\$10.00	\$17.60	\$0.00	\$70.29
For apprentice rates see "Apprentice- PLUMBER/PIPEFITTER" or "PLUMBER/GASFITTER"						
Outside Electrical - East						
CABLE TECHNICIAN (Power Zone) <i>OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104</i>	09/03/2017	\$27.14	\$7.75	\$1.81	\$0.00	\$36.70
For apprentice rates see "Apprentice- LINEMAN"						
CABLEMAN (Underground Ducts & Cables) <i>OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104</i>	09/03/2017	\$38.45	\$7.75	\$9.53	\$0.00	\$55.73
For apprentice rates see "Apprentice- LINEMAN"						
DRIVER / GROUNDMAN CDL <i>OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104</i>	09/03/2017	\$31.66	\$7.75	\$9.44	\$0.00	\$48.85
For apprentice rates see "Apprentice- LINEMAN"						
DRIVER / GROUNDMAN -Inexperienced (<2000 Hrs) <i>OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104</i>	09/03/2017	\$24.88	\$7.75	\$1.75	\$0.00	\$34.38
For apprentice rates see "Apprentice- LINEMAN"						
EQUIPMENT OPERATOR (Class A CDL) <i>OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104</i>	09/03/2017	\$38.45	\$7.75	\$13.61	\$0.00	\$59.81
For apprentice rates see "Apprentice- LINEMAN"						
EQUIPMENT OPERATOR (Class B CDL) <i>OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104</i>	09/03/2017	\$33.92	\$7.75	\$10.21	\$0.00	\$51.88
For apprentice rates see "Apprentice- LINEMAN"						
GROUNDMAN <i>OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104</i>	09/03/2017	\$24.88	\$7.75	\$1.75	\$0.00	\$34.38
For apprentice rates see "Apprentice- LINEMAN"						
GROUNDMAN -Inexperienced (<2000 Hrs.) <i>OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104</i>	09/03/2017	\$20.35	\$7.75	\$1.61	\$0.00	\$29.71

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
For apprentice rates see "Apprentice- LINEMAN"						
JOURNEYMAN LINEMAN <i>OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104</i>	09/03/2017	\$45.23	\$7.75	\$16.61	\$0.00	\$69.59

Apprentice - LINEMAN (Outside Electrical) - East Local 104

Effective Date - 09/03/2017

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	60	\$27.14	\$7.75	\$3.31	\$0.00	\$38.20
2	65	\$29.40	\$7.75	\$3.38	\$0.00	\$40.53
3	70	\$31.66	\$7.75	\$3.45	\$0.00	\$42.86
4	75	\$33.92	\$7.75	\$5.02	\$0.00	\$46.69
5	80	\$36.18	\$7.75	\$5.09	\$0.00	\$49.02
6	85	\$38.45	\$7.75	\$5.15	\$0.00	\$51.35
7	90	\$40.71	\$7.75	\$7.22	\$0.00	\$55.68

Notes:

Apprentice to Journeyworker Ratio:1:2

TELEDATA CABLE SPLICER <i>OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104</i>	02/05/2018	\$29.98	\$4.70	\$3.15	\$0.00	\$37.83
	02/04/2019	\$30.73	\$4.70	\$3.17	\$0.00	\$38.60
TELEDATA LINEMAN/EQUIPMENT OPERATOR <i>OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104</i>	05/05/2018	\$28.22	\$4.70	\$3.10	\$0.00	\$36.02
	02/04/2019	\$28.93	\$4.70	\$3.14	\$0.00	\$36.77
TELEDATA WIREMAN/INSTALLER/TECHNICIAN <i>OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104</i>	02/05/2018	\$28.22	\$4.70	\$3.10	\$0.00	\$36.02
	02/04/2019	\$28.93	\$4.70	\$3.14	\$0.00	\$36.77
TREE TRIMMER <i>OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104</i>	01/31/2016	\$18.51	\$3.55	\$0.00	\$0.00	\$22.06
This classification applies only to tree work done: (a) for a utility company, R.E.A. cooperative, or railroad or coal mining company, and (b) for the purpose of operating, maintaining, or repairing the utility company's equipment, and (c) by a person who is using hand or mechanical cutting methods and is not on the ground. This classification does not apply to wholesale tree removal.						
TREE TRIMMER GROUNDMAN <i>OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104</i>	01/31/2016	\$16.32	\$3.55	\$0.00	\$0.00	\$19.87
This classification applies only to tree work done: (a) for a utility company, R.E.A. cooperative, or railroad or coal mining company, and (b) for the purpose of operating, maintaining, or repairing the utility company's equipment, and (c) by a person who is using hand or mechanical cutting methods and is on the ground. This classification does not apply to wholesale tree removal.						

Additional Apprentice Information:

Minimum wage rates for apprentices employed on public works projects are listed above as a percentage of the pre-determined hourly wage rate established by the Commissioner under the provisions of the M.G.L. c. 149, ss. 26-27D. Apprentice ratios are established by the Division of Apprenticeship Training pursuant to M.G.L. c. 23, ss. 11E-11L.

All apprentices must be registered with the Division of Apprenticeship Training in accordance with M.G.L. c. 23, ss. 11E-11L.

All steps are six months (1000 hours.)

Ratios are expressed in allowable number of apprentices to journeymen or fraction thereof, unless otherwise specified.

** Multiple ratios are listed in the comment field.

*** APP to JM; 1:1, 2:2, 2:3, 3:4, 4:4, 4:5, 4:6, 5:7, 6:7, 6:8, 6:9, 7:10, 8:10, 8:11, 8:12, 9:13, 10:13, 10:14, etc.

**** APP to JM; 1:1, 1:2, 2:3, 2:4, 3:5, 4:6, 4:7, 5:8, 6:9, 6:10, 7:11, 8:12, 8:13, 9:14, 10:15, 10:16, etc.

**WEEKLY PAYROLL RECORDS REPORT
& STATEMENT OF COMPLIANCE**

In accordance with Massachusetts General Law c. 149, §27B, a true and accurate record must be kept of all persons employed on the public works project for which the enclosed rates have been provided. A Payroll Form has been printed on the reverse of this page and includes all the information required to be kept by law. Every contractor or subcontractor is required to keep these records and preserve them for a period of three years from the date of completion of the contract.

In addition, every contractor and subcontractor is required to submit a copy of their weekly payroll records to the awarding authority. This is required to be done on a weekly basis. Once collected, the awarding authority is also required to preserve those records for three years from the date of completion of the project.

Each such contractor or subcontractor shall furnish to the awarding authority directly within 15 days after completion of its portion of the work, a statement, executed by the contractor, subcontractor or by any authorized officer thereof who supervised the payment of wages, this form.

STATEMENT OF COMPLIANCE

_____, 20_____

I, _____, _____
(Name of signatory party) (Title)

do hereby state:

That I pay or supervise the payment of the persons employed by
_____ on the _____
(Contractor, subcontractor or public body) (Building or project)

and that all mechanics and apprentices, teamsters, chauffeurs and laborers employed on said project have been paid in accordance with wages determined under the provisions of sections twenty-six and twenty-seven of chapter one hundred and forty nine of the General Laws.

Signature _____
Title _____

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MASSACHUSETTS WEEKLY CERTIFIED PAYROLL REPORT FORM



Company's Name:			Address:				Phone No.:			Payroll No.:									
Employer's Signature:			Title:				Contract No.:		Tax Payer ID No.:		Work Week Ending:								
Awarding Authority's Name:			Public Works Project Name:				Public Works Project Location:			Min. Wage Rate Sheet No.:									
General / Prime Contractor's Name:			Subcontractor's Name:				"Employer" Hourly Fringe Benefit Contributions												
Employee Name & Complete Address	Employee is OSHA 10 Certified (?)	Work Classification:	Appr. Rate (%)	Worked Hours							Project Hours (A) All Other Hours	Hourly Base Wage (B)	Health & Welfare Insurance (C')	ERISA Pension Plan (D)	Supp. Unemp. (E)	Total Hourly Prev. Wage (F)	(B+C+D+E)	(A x F)	Check No. (H)
				Su.	Mo.	Tu.	We.	Th.	Fr.	Sa.							Project Gross Wages (G) Total Gross Wages		

NOTE: Pursuant to MGL Ch. 149 s.27B, every contractor and subcontractor is required to submit a "true and accurate" copy of their weekly payroll records directly to the awarding authority. Failure to comply may result in the commencement of a criminal action or the issuance of a civil citation.

Date recieved by awarding authority / /
--

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Section 01 10 00
SUMMARY

PART 1 - GENERAL

1.1 SUMMARY

- A. Project description.
- B. Project's environmental goals.
- C. Definitions – Owner, and Architect.
- D. Work by Owner.
- E. Work restrictions.
 - 1. Use of Site.
 - 2. Access to Site.
 - 3. Coordination with Occupants.
- F. Owner occupancy.
- G. Project Manual formats and conventions.

1.2 PROJECT DESCRIPTION

- A. Work covered by Contract Documents:
 - 1. Description: Pope's Tavern, Halifax, is a two story, wood frame, clapboard style building originally constructed in 1830, and last renovated in 1986. The general scope of work for this renovation and addition includes the following:
 - a. Site improvements.
 - b. Renovation of existing space, includes new accessible toilets on the First Floor, new renovated program spaces on the Second Floor.
 - c. Building addition includes a new multi-purpose community room, with associated kitchen and accessible elevator. The Second floor has space for future expansion.
 - d. New mechanical, electrical, plumbing and fire protection systems for the renovated and newly constructed spaces.
 - 2. Project Address:
 - 506 Plymouth Street
 - Halifax, MA 02338
 - 3. Work included beyond the Contract Limits: Protection and replacement of abutting sidewalks and roadways in public way, and on adjacent properties.
 - 4. Completeness: The Work shall be as shown on the Drawings and be complete in every respect and in conformance with all applicable requirements of the governing laws and codes.
- B. Contract time: The Contractor may begin on-site work on, or within 10 calendar days from date of a written Notice to Proceed. After commencement of work, the Contractor shall pursue the Work continuously and with diligence, and bring the

Project to Substantial Completion within 270 calendar days from date of Notice to Proceed.

1. Substantial completion is the stage in the progress of the Work when the work or designated portion thereof is sufficiently complete in accordance with the Contract Documents so the Owner can occupy or utilize the Work for its intended use. This includes any and all permits required by governmental agencies necessary for occupancy and use.
 2. Final Completion of the Contract shall occur within 30 days after the Substantial Completion Date.
 3. Liquidated Damages stipulated in the Owner-Contractor Agreement are applicable for failure to achieve Substantial Completion by date required.
- C. Building Permits: Contractor is responsible to ensure all required permits are obtained, and that the work pertaining to permits is properly inspected and certified. Filed Subcontractors are required to obtain permits relating to their work.

1.3 PROJECT ENVIRONMENTAL GOALS

- A. Objectives: Utilize pollution prevention materials, sustainable construction methods, low VOC and no off-gassing, products to maintain of healthy Indoor Air Quality (IAQ) during the construction process:
1. Incorporate green products and sustainable materials into the Project. To the greatest extent possible, the Contractor shall:
 - a. Use products with low embodied energy (production, manufacturing, and transportation).
 - b. Use products that maximize recycled content in materials products, and systems.
 - c. Use products easy to maintain, repair, and that can be cleaned using non-toxic substances..
 - d. Use products that will not negatively affect healthy indoor air quality.
 - e. Use reusable and recyclable packaging.
 - f. Avoid use of ozone-depleting compounds, such as HCFCs from refrigerants or foam insulation materials.
- B. Water resource protection: Conserve and use water efficiently, limit on-site fresh water usage to the greatest extent possible, control water distribution systems and waste, minimize use of imported or mined water. Utilize water-conserving appliances and equipment.
- C. Air Quality is achieved by compliance with the limitation of indoor air concentrations of certain pollutants, at or below the established maximum allowable concentrations. Healthy air quality goals shall be maintained during construction, and through building commissioning.
1. Use construction practices that achieve the most efficient use of resources and materials.

1.4 DEFINITIONS - OWNER, AND ARCHITECT

- A. Wherever the term "Owner" is used in this specification, it refers to:

Town of Halifax
499 Plymouth Street
Halifax, MA 02338

1. The terms "Owner" and "Awarding Authority" as used in the Project Manual have the same meaning and are interchangeable in Contract Documents. Both terms refer to the same entity.
 2. Important Tax Note: OWNER is exempt from certain taxes. It is therefore required that the Contractor and all Subcontractors purchasing taxable goods or services make known to suppliers that tax-exempt status of the Owner, in order that such taxes will not be applied to the goods under Contract. In the event that such taxes are paid on any items, the Contractor shall obtain rebates for the taxes and reimburse the Owner in the full amount by change order. The Owner will provide the necessary evidence and certificates of its tax-exempt status upon request of those concerned. The most prevalent taxes concerned are:
 - a. Federal Excise Taxes as applied to articles which are taxable under Chapter 32 of the Internal Revenue Code of 1954, as amended. The Owner's Excise Tax Exemption Certificate Number is: 00-00-0000F is applicable.
 - b. Sales and Use Tax imposed by the Commonwealth of Massachusetts: The Owner has been assigned Exemption Certificate Number with respect to leases, rental, or purchase of "tangible personal property", including building materials and supplies, subject to the Massachusetts Sales and Use Tax. This exemption does not apply to any equipment leased or rented by the Contractor for his own use on the construction of the Project.
 - c. Fines and Penalties: Contractor and subcontractors are fully responsible for payment of all penalties and fines assessed by authorities having jurisdiction for improper and illegal use of Owner's tax exemption certificate number.
 3. All papers required to be delivered to the Owner shall, unless otherwise specified in writing to the contrary, be delivered to the office of the Architect:
- B. Wherever the term "Architect", "Designer", or "Architect/Engineer", is used in the Contract Documents, it refers to:
- Winslow Architects, Inc.
89 Massachusetts Avenue
Arlington, MA 02474

1.5 WORK BY OWNER

- A. Related work under separate agreements: The Owner will award separate contracts which may commence prior to, or during the work of this Contract. Work under separate agreements, in general include the following:
1. Testing Laboratory Services.
 2. Owner Furnished and Installed (OFI) Products: The Contractor has coordinating responsibility for the following work, provided by others under separate agreement(s) with the Owner:
 - a. Security alarm and detection systems.
 - b. Furnishings and equipment, artwork, loose casegoods and similar items.

July 11, 2018

1.6 USE OF SITE

- A. Use of, and access to, site may be subject to special requirements of the Owner, as directed.
 - 1. Prior to beginning the Work of this Contract, the Contractor shall meet with the Owner and the Architect to determine procedures regarding access and use of the site, locations and access to staging and storage areas, tree protection, temporary barriers and fencing, and any special site conditions or restrictions regarding the use of the site areas surrounding the construction.
 - 2. Hours of construction, **7:30 AM to 4:30 PM** local time, Monday to Friday. Provisions for working hours other than those specified, must be pre-arranged with the Owner.
 - 3. Security: Owner Staff access must be permitted at all times in all construction areas, for purposes of security.
- B. Confine operations to areas within Contract limits indicated on the Drawings. Portions of the site and building beyond areas in which construction operations are indicated are not to be disturbed.
 - 1. Use of on-site areas outside of the contract limits for workers parking or storage of materials must be pre-arranged with Owner. Schedule deliveries to minimize requirements for storage of materials.
- C. Contractor shall coordinate and permit uninhibited Owner's access to site prior to Substantial Completion as required for installation of equipment and furnishings performed under separate contracts outside of this Work.

1.7 ACCESS TO SITE

- A. The Owner intends to occupy parking areas and access roads during construction. Notify the Owner of work which will affect the use of these areas; coordinate work schedule with Owner. The Contractor shall consult with the Owner on the best ways to provide access and on changes to access areas as the work progresses.
- B. Keep all public roads and walks, and access drive to facility clear of debris caused by this Work during building operations.

1.8 COORDINATION WITH OCCUPANTS

- A. General: Perform all work in such a manner as to prevent interference with the Owner's operation of the facility, nor endanger the health, safety and well-being of the facility's staff and building's occupants .
 - 1. Take all measures to insure the safety of staff and the general public. The Contractor must take every reasonable precaution and employ all necessary measures including extra cleaning, special supervisory personnel, and additional temporary barriers and signage to facilitate the clean, quiet, safe, and continual operation of the facility.
 - 2. The work will be done in an occupied building active site accessible to the public. It is imperative that the Contractor, its subcontractors and all their personnel treat the staff and building's occupants with consideration and respect. No unnecessary noise or disruption of the activities of the will be permitted.

- B. Interruption of services: Any major work entailing disruption to heating, lighting, life safety system utility connections or other similar major disruption to building functioning must be coordinated with the Owner, and temporary services, safety precautions, or connections provided. Do not shut down any service without approval of the Owner.
 - 1. Provide both Owner and Architect with **72 hour (3 work days minimum)** notification for any disruption of service; provide notification for connecting, disconnecting, turning on or turning off any service which may affect Owner's operations.
 - 2. Provide **72 hour (3 work days minimum)** notice to local fire department of disruptions in electrical services, fire alarm services and emergency power services.
 - 3. Any action either planned or unplanned, by the Contractor which impairs the operation of anyone or the activation of the fire alarm detection and or suppression system shall cause notification of the appropriate party. In case of unplanned, accidental, impairment, the Contractor will immediately notify the Owner. The Contractor should be prepared to provide assistance as required to correct the problem.

1.9 OWNER'S OCCUPANCY

- A. Prior to the Date of Substantial Completion of this Contract, the Contractor agrees to the use and occupancy of the building or any portion thereof by the Owner provided the Owner secures written consent of the Contractor, such consent not to be unreasonably withheld.
- B. If the Project has not been substantially completed by the specified date, the Owner may from time to time occupy the building or any portion thereof as the work thereon is completed to such extent that it is usable for the purpose for which it is intended.
 - 1. The Owner will give notice to the Contractor prior to any such occupancy, subject to the following:
 - a. In the case of partial occupancy prior to the specified date of Substantial Completion, the Owner shall secure endorsement from the local building inspection authority, insurance carrier, and consent of the Surety permitting occupancy during the remaining period of construction.
 - b. In case of partial occupancy after the specified date of Substantial Completion, the Contractor shall extend all necessary insurance coverage until final acceptance of the Project. Owner's use and occupancy prior to final acceptance shall not relieve the Contractor of his responsibility to maintain the insurance coverage required by the Contract Documents.
- C. Occupancy of the building or any portion thereof by the Owner does not constitute an acceptance of the Work or portion thereof, it does not relieve Contractor of responsibility to perform any of the required work not completed at the time of occupancy.
- D. Contractor shall not be required to furnish heat, light, or water used by the Owner in such occupancy, nor pay maintenance costs, nor shall be responsible for wear

and tear or damage in the occupied portions of the building which are a direct result from such occupancy.

1.10 PROJECT MANUAL FORMATS AND CONVENTIONS

- A. Project Manual Format: The Project Manual is organized into Divisions and subdivided into Sections and Documents using Construction Specification Institute (CSI) publication "MasterFormat" numbering system, 2016 edition.
1. Section Identification: Six/Eight digit Section numbers are utilized and cross-referenced throughout the Contract Documents. Sections in the Project Manual are in numeric sequence; however, the sequence is incomplete because only those Section numbers which are applicable to this Project are used.
 2. Division One of the Project Manual governs procedural and administrative requirements of the Work. Division One requirements are applicable to all Sections and Documents in the Project Manual.
- 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 as applicable to the context of the Contract Documents.
 2. Imperative mood and streamlined language is 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

Section 01 22 00
UNIT PRICES

PART 1 - GENERAL

1.1 SUMMARY

- A. Measurement and payment criteria applicable to portions of the Work performed under a unit price payment method.
- B. Non-payment for rejected unit price Work.

1.2 RELATED REQUIREMENTS

- A. Section 03 30 00 – Cast-in-Place Concrete: Measurement for underpinning work requiring unit price payment.
- B. Section 06 10 00 – ROUGH CARPENTRY: Measurement for sistering roof joists, requiring unit price payment.
- C. Section 06 16 00 – SHEATHING: Measurement for roof sheathing work requiring unit price payment.

1.3 AUTHORITY

- A. Measurement methods delineated in the individual specification sections are intended to complement the criteria of this Section. In the event of conflict, the requirements of the individual specification section shall govern.
- B. Take all measurements and compute quantities. The Architect/Engineer will verify measurements and quantities.
- C. Assist by providing necessary equipment, workers, and survey personnel as required.

1.4 UNIT QUANTITIES SPECIFIED

- A. Quantities and measurements indicated in the Bid Form are for bidding and contract purposes only. Quantities and measurements supplied or placed in the Work and verified by the Owner shall determine payment.
- B. If the actual Work requires more or fewer quantities than those quantities indicated, provide the required quantities at the unit sum/prices contracted.

1.5 MEASUREMENT OF QUANTITIES

- A. Measurement devices:
 - 1. Weigh scales: Inspected, tested and certified by applicable weights and measures department within the past year.
 - 2. Platform scales: Of sufficient size and capacity to accommodate the conveying vehicle.
 - 3. Metering devices: Inspected, tested and certified by applicable department within the past year.

July 11, 2018

- B. Measurement by weight: Concrete reinforcing steel, rolled or formed steel or other metal shapes will be measured by handbook weights. Welded assemblies will be measured by handbook or scale weight.
- C. Measurement by volume: Measured by cubic dimension using mean length, width and height or thickness.
- D. Measurement by area: Measured by square dimension using mean length and width or radius.
- E. Linear measurement: Measured by linear dimension, at the item centerline or mean chord.
- F. Stipulated sum/price measurement: Items measured by weight, volume, area, or linear means or combination, as appropriate, as a completed item or unit of the Work.

1.6 PAYMENT

- A. Payment includes: Full compensation for all required labor, Products, tools, equipment, plant, transportation services and incidentals; erection, application or installation of an item of the Work; overhead and profit.
- B. Final payment for Work governed by unit prices will be made on the basis of the actual measurements and quantities accepted by the Architect/Engineer multiplied by the unit sum/price for Work which is incorporated in or made necessary by the Work.

1.7 NON-PAYMENT FOR REJECTED PRODUCTS

- A. Payment will not be made for any of the following:
 - 1. Products wasted or disposed of in a manner that is not acceptable.
 - 2. Products determined as unacceptable before or after placement.
 - 3. Products not completely unloaded from the transporting vehicle.
 - 4. Products placed beyond the lines and levels of the required work.
 - 5. Products remaining on hand after completion of the Work.
 - 6. Loading, hauling and disposing of rejected Products.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

End of Section

Section 01 23 00
ALTERNATES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section consists of:
 - 1. Submission procedures for scheduled Alternates.
 - 2. Documentation of changes to Contract Sum and Contract Time.
- B. The description of Alternates herein below and through the Specifications are intended to set the intent and to describe the major work only. Such descriptions are not to be taken as limiting the work required under any of the alternates, and all work required to carry out the intent of each of the accepted Alternates shall be done without cost additional to that agreed upon as the alternate price.

1.2 REQUIREMENTS

- A. Submit Alternates with full description of the proposed alternate and affect on adjacent or related components.
- B. Alternates quoted on Bid Forms will be reviewed and accepted or rejected at the Owner's option. Accepted alternates will be identified in the Owner-Contractor Agreement.
- C. Coordinate related work and modify surrounding work to integrate the Work of each Alternate.

1.3 SELECTION AND AWARD OF ALTERNATES

- A. Indicate variation of Bid Price for Alternates described below and list where provided for Bid Form or any supplement to it, which requests a difference in Contract Price by adding to or deducting from the base bid price.
- B. The lowest responsible and eligible bid will be determined on the basis of the base bid, adjusted by such alternate or alternates as may be included in the award of the Contract in the sole discretion of the Awarding Authority.

1.4 SCHEDULE OF ALTERNATES

- A. ALTERNATE 1 – REPLACE SIDING:
 - 1. Base bid: Replace siding at west wall.
 - 2. Alternate number 1: Add replacement of siding on East wall (front portion of existing building) with same details as shown for the West wall, included in Base Bid.
- B. ALTERNATE 2 – DRAINAGE SWALE:
 - 1. Base bid: No work.
 - 2. Alternate number 2: Add drainage swale as shown on Plan C-003

- C. ALTERNATE 3 – PARKING:
 - 1. Base bid: Existing parking to remain.
 - 2. Alternate number 3: Add parking area as shown on Drawing C-003.

- D. ALTERNATE 4 – REFLASH AND REPAIR CHIMNEYS:
 - 1. Base bid: Existing chimneys to remain.
 - 2. Alternate number 4: Reflash, repair and repoint existing chimneys

- E. ALTERNATE 5 – RESHINGLE EXISTING ROOF:
 - 1. Base bid: Existing roofing to remain.
 - 2. Alternate number 5: Remove existing roofing, and reshingle roof. Work of this alternate includes:
 - a. Unit price work to remove and replace with new, 20% of existing sheathing (rotted, dry-rot or otherwise unsuitable), under provisions of Section 06 10 00 – ROUGH CARPENTRY.
 - b. Unit price work to repair existing roof rafters by adding reinforced “sister” rafters of equal size for 20% of existing rafters, under provisions of Section 06 10 00 – ROUGH CARPENTRY.
 - c. Moisture shedding underlayment, eave, valley and ridge protection.
 - d. Aluminum drip edge and trim at roof perimeter
 - e. Asphalt shingle roof as specified under Section 07 31 13.

- F. ALTERNATE 6 – REMOVAL AND REPLACEMENT OF WINDOWS:
 - 1. Base bid: Existing windows designated “EX” to remain.
 - 2. Alternate number 6: Add removal and replacement of windows designated as “EX” windows in existing building with new fiberglass windows with detail to match existing 6/6 muntin pattern.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

End of Section

Section 01 25 13
PRODUCT SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Product options.
 - 1. Product selections.
 - 2. Additional product selection requirements regarding sustainable and environmental-friendly products.
 - 3. Visual matching.
- B. Product substitution procedures.

1.2 RELATED REQUIREMENTS

- A. Section 01 60 00 - PRODUCT REQUIREMENTS: Basic product requirements.

1.3 PRODUCT OPTIONS

- A. Product selections: Comply with the following for selection of products:
 - 1. Products specified by reference standards or by description only: Provide any acceptable product meeting those standards or description.
 - 2. Products specified by performance requirements only: Provide any acceptable product which has been tested to show compliance with specified requirements, including indicated performances.
 - 3. Products specified by naming one or more manufacturers: Provide products of manufacturers named, or submit a request for substitution for any manufacturer or product not named in accordance with Massachusetts General Laws, Chapter 30, Section 39M(b).
- B. Additional product selection requirements regarding sustainable and environmental-friendly products and materials conforming to Owner's sustainable/environmental program.
 - 1. Provide products which comply with VOC emission limits required by the Owner's Sustainability/Environmental Policy and in compliance with applicable codes.
 - 2. Provide products which comply with specified requirements for recycled content.
 - 3. Provide complete written documentation with all product substitutions that the proposed products are fully compliant to specific environmental and sustainability requirements applicable to the substitution.
- C. Visual matching: Where Specifications require matching a sample, the Architect's decision on whether a proposed product matches is final. Where no product matches and complies with other requirements, comply with provisions for "substitutions" for selection of a matching product in another category.

July 11, 2018

1.4 PRODUCT SUBSTITUTION

- A. Products specified by reference standards or by description only: Any product meeting those standards or description.
- B. Pursuant to Massachusetts General Laws, Chapter 30, Section 39M(b), where products or materials are prescribed by manufacturer name, trade name or catalog reference, the word "or approved equal" shall be implied. The Architect will evaluate the proposed "equal" item on the following criteria:
 - 1. The submitted "equal" item is at least equal in quality, durability, appearance, strength and design.
 - 2. The submitted "equal" item is at least equal in function for the purpose intended by the design of the Work.
 - 3. The submitted "equal" item conforms substantially to the detailed requirements for the items as indicated by the specifications.
 - 4. The submitted "equal" item fully conforms to the sustainability and environmental requirements to comply with Owner's Sustainability/Environmental Policy.
- C. The Architect's evaluation and decision on whether a proposed product is equal to that specified, based on the above evaluation requirements, is final. The Contractor retains the right to appeal the Architect's determination of equality through regulated statutory provisions.
 - 1. The Architect and Owner reserve the right to reject proposed substitutions where data for VOCs is not provided or where emissions of individual VOCs are higher than for specified materials.
- D. Where Specifications require matching existing materials, the Architect's decision on whether a proposed product matches is final.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

End of Section

Section 01 31 00
PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Project coordination.
- B. Project meetings.

1.2 RELATED REQUIREMENTS

- A. Section 01 32 00 - CONSTRUCTION PROGRESS DOCUMENTATION.
- B. Section 01 33 00 - SUBMITTAL PROCEDURES.
- C. Section 01 73 29 - CUTTING AND PATCHING.
- D. Section 01 78 00 - CLOSEOUT SUBMITTALS: Requirements for Project Record Drawings (As-built drawings).
- E. Section 02 41 19 - SELECTIVE DEMOLITION.

1.3 GENERAL PROJECT COORDINATION

- A. Coordination: The General Contractor is fully responsible for coordinating the Work of this Contract including scheduling, submittals, Work and other activities included in various Sections to assure efficient and orderly sequence of installation of interdependent construction elements. The General Contractor is responsible for coordinating actual installed location and interface of work, and to make provisions to accommodate items scheduled for later installation.
- B. Where installation of one component depends on installation of other components before or after its own installation, schedule activities in the sequence required to obtain efficient installation with the least amount of alterations, or cutting and patching, to completed Work.
 - 1. The Contractor shall be responsible to uncover work completed in order to install ill-timed work, at no additional cost to the Owner.
- C. Where space is limited, coordinate installation of different components to assure maximum accessibility for maintenance, service and repair.
- D. Coordinate space requirements and installation of mechanical and electrical work which are indicated diagrammatically on Drawings. Follow routing shown for pipes, ducts, and conduit, as closely as practicable; place runs parallel with line of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.
- E. Verify that utility requirement characteristics of operating equipment are compatible with building utilities. Coordinate work of various Sections having interdependent responsibilities for installing, connecting to, and placing in service such equipment.

July 11, 2018

- F. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.
- G. Coordinate completion and clean up of Work of separate Sections in preparation for Substantial Completion and for portions of Work designated for Owner's partial occupancy.
- H. After Owner occupancy of premises, coordinate access to site for correction of defective Work and Work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

1.4 UTILITIES, MECHANICAL AND ELECTRICAL COORDINATION

- A. Coordinate all Work of this Project. Provide full and complete coordination for utilities, mechanical and electrical work in Divisions 11, 13, 21 through 28 and 33, with Work of other Divisions.
 - 1. Each Filed-subcontractor shall compare his drawings and specifications with those of other Trades and report any discrepancies between them to the General Contractor. The General Contractor shall obtain from the Architect written instructions for changes necessary in the mechanical or electrical work, to ensure that all work is installed in coordination and cooperation with other Trades installing interrelated work. Before installation, each Filed-subcontractor shall make proper provisions to avoid interferences in a manner approved by the Architect. All changes required in the work of each Filed-subcontractor caused by his negligence, shall be corrected by him at his own expense, to the Architect's satisfaction.
- B. Give all advance notice to public utility companies as required by law, and provide proper disposition, subject to Architect's approval of all existing pipe lines, conduits, sewers, drains, poles, wiring, and other utilities that in any way interfere with the Work, whether or not they are specifically shown on the Drawings.
- C. Coordination regarding existing utilities:
 - 1. Notify Owner and appropriate authorities when coming across an unknown utility line(s), and await decision as to how to dispose of same.
 - 2. When an existing utility line must be cut and plugged or capped, moved, or relocated, or has become damaged, notify the Owner and Utility company involved, and assure the protection, support, or moving of utilities to adjust them to the new work.
 - 3. The Contractor shall be responsible for all damage caused to existing, active utilities located within the limits of this Contract, whether or not such utilities are shown on the Drawings, including resultant damages or injuries to persons or properties.
- D. General coordination of piping, ductwork, conduits and equipment:
 - 1. The Contract Drawings are diagrammatic only intending to show general runs and general locations of piping, ductwork, equipment and sprinkler heads. Determine exact routing and location of individual systems prior to fabrication of components or installation.
 - a. Piping runs requiring pitch have "right-of-way" over those systems that do not pitch.

- b. System components whose elevations cannot be changed have "right-of-way" over those components whose elevations can be changed.
 - 2. Adjust locations of piping, ductwork, conduits and equipment as required to accommodate new work with interferences anticipated and as encountered during installation.
 - a. Locate piping, conduits and ductwork to be clear of swinging doors, access doors, and clear for unimpeded equipment access.
 - 3. Provide all offsets, transitions and changes of direction for all systems, as may be required to maintain proper clearances for headroom, and as may be required for coordination with other "fixed-in-place" building components (such as structural systems).
 - a. Furnish all vents, drains and similar accessories as may be required for offsets, transitions and changes of direction.
 - 4. Provide openings in the work for penetration of mechanical and electrical work.
 - 5. Coordinate final locations of ceiling mounted devices (including air distribution devices, thermostats, heaters, control devices, sprinkler heads and similar work) with reflected ceiling plans. Review locations with Architect and obtain approval of all devices prior to installation.
- E. Utility penetrations through rated construction: Notify Owner of all locations of every penetration in fire resistant rated partitions and walls, in smoke barriers, and in fire barriers, including but not limited to penetrations for elevators, plumbing, fire suppression, heating, ventilating and air conditioning, electrical systems, telephone systems, communications systems, building controls systems, and specialized wiring and piping for medical equipment.
 - 1. Comply with requirements of Section 07 84 00 – FIRESTOPPING for installation of fireproof firestopping, firesafing materials, smoke seals and related accessories.
 - a. Provide removable (temporary) firestopping to maintain fire integrity until permanent firestopping assemblies can be installed.
 - 2. Allow for inspection prior to installation of suspended ceilings or concealed by other materials that may conceal firestopping work.

1.5 COORDINATION OF CUTTING AND PATCHING

- A. Cutting and patching coordination: The General Contractor is responsible for coordination of all cutting and patching necessary for the completion of this Contract and for the quality and appearance of all patch Work in exposed-to-view finished materials.
- B. General cutting and patching: Comply with requirements of Section 01 73 29 - CUTTING AND PATCHING.
 - 1. Do not drill through structural beams, slabs or columns. Core drilling through concrete unit masonry and stair platforms must be approved by the Architect.

1.6 COORDINATION DOCUMENTS

- A. General: Prepare coordination drawings for areas where close coordination is required for installation of products and materials fabricated off-site by separate

entities, and where limited space necessitates maximum utilization of space for efficient installation of different components.

1. Coordination Drawings include, but are not necessarily limited to:
 - a. Structure.
 - b. Partition/room layout.
 - c. Ceiling layout and heights.
 - d. Light fixtures.
 - e. Access panels.
 - f. Sheet metal, heating coils, boxes, grilles, diffusers, and similar items.
 - g. All heating piping and valves.
 - h. Smoke and fire dampers.
 - i. Soil, waste and vent piping.
 - j. Major water.
 - k. Major electrical conduit runs, panelboards, feeder conduit and racks of branch conduit.
 - l. Above ceiling miscellaneous metal.
 - m. Sprinkler piping and heads.
 - n. All equipment, including items in the Contract as well as OFCI and OFI items.
 - o. Equipment located above finished ceiling requiring access for maintenance and service. In locations where acoustical lay-in ceilings occur, indicate areas in which the required access area may be greater than the suspended grid system.
 - p. Existing conditions, including but not limited to mechanical, plumbing, fire protection and electrical items.
 - q. Seismic Restraints.
- B. Timing: Prior to fabricating materials or beginning work, supervise and direct the creation of one complete set of coordination drawings showing complete coordination and integration of work, including, but not limited to, structural, architectural, mechanical, plumbing, fire protection, elevators, and electrical disciplines.
- C. Intent: Coordination drawings are for the General Contractor's and Filed-Subcontractor's use during construction and are not to be construed as replacing shop drawings or record drawings. Architect's review of submitted coordination drawings shall not relieve the General Contractor from his overall responsibility for the coordination of the Work of the Contract.
- D. Base sheets: Architect will provide CAD files for use by the General Contractor for the development of building coordination drawing "base sheets" upon signed receipt of Architect's disclaimer form. General Contractor is responsible to prepare and provide one accurately scaled set of building coordination drawing "base sheets" showing all architectural and structural work. Base sheets shall be at appropriate scale; congested areas and sections through vertical shafts shall be at larger scale.
 1. Highlight all fire rated and smoke partitions.

2. Indicate horizontal and vertical dimensions to avoid interference with structural framing, ceilings, partitions, and other services.
 3. Indicate elevations relative to finish floor for bottom of ductwork and piping and conduit (6 inches and greater in diameter).
 4. Indicate the main paths for the installation, or removal of, equipment from mechanical and electrical rooms.
- E. General Contractor shall circulate coordination drawings to the following subcontractors and any other installers whose work might conflict with other work. Each of these subcontractors shall accurately and neatly show actual size and location of respective equipment and work. Each subcontractor shall note apparent conflicts, suggest alternate solutions, and return drawings to General Contractor.
1. Plumbing Filed-subcontractor.
 2. Fire protection Filed-subcontractor.
 3. Heating ventilating and air conditioning Filed-subcontractor(s).
 4. Electrical discipline Filed-subcontractor(s).
- F. Review and modify and approve coordination drawings in cooperation with individual installers and Filed-subcontractors to assure conflicts are resolved before work in field is begun and to ensure location of work exposed to view is as indicated or as approved by Architect.
1. The General Contractor shall stamp, sign and submit coordination drawing originals to Architect for review.
 2. Do not commence work in areas described in the coordination drawings until receipt of Architect's comments.

1.7 GENERAL PROJECT ADMINISTRATION

- A. Prepare memoranda for distribution to each party involved outlining required coordination procedures. Include required notices, reports, and attendance at meetings.
- B. Prepare similar memoranda for the Owner and separate contractors where coordination of their Work is required.
- C. Conduct conferences among Filed-subcontractors, subcontractors and others concerned with the Work, to establish and maintain coordination and schedules, and to resolve coordination matters in dispute.
- D. Administrative Procedures: Coordinate scheduling and timing of administrative procedures with other activities to avoid conflicts and ensure orderly progress. Such activities include:
 1. Preparation of schedules.
 2. Installation and removal of temporary facilities.
 3. Delivery and processing of submittals.
 4. Progress meetings.
 5. Project Closeout activities.

1.8 SITE MOBILIZATION AND PHASING CONFERENCE

- A. In addition to the pre-bid conference specified under Section 00 1 16 - INVITATION TO BID, prior to commencement of the Work, schedule a meeting at a meeting room provided by the Owner.
1. Meeting shall take place not less than 14 calendar days prior to start of construction.
 2. Attendance is required by Owner, Architect, Owner's Project Representative, Duxbury Senior Center director or designated representative, designated engineering consultants, General Contractors' Project Manager and Superintendent, Filed-subcontractors, and other major subcontractors, applicators, installers and suppliers. Other persons are required to attend as the Architect may direct, or the Contractor may wish to have present.
 3. Items of Agenda:
 - a. Use of premises by Owner, Contractor, and subcontractor(s).
 - 1) Use of existing parking areas and site.
 - 2) Tree and shrub protection.
 - b. Owner's requirements, project phasing, and Owner's occupancy considerations.
 - c. Demolition procedures, identity tagging of existing furnishings and equipment for salvage or disposal.
 - d. Temporary utilities.
 - e. Barricading and protection of the public, dust barriers.
 - f. Survey, site and building layout.
 - g. Potentially difficult areas of work.
 - h. Project coordination.
 - i. Indoor air quality standards and testing requirements.
 - j. Security and housekeeping procedures.
 - k. Construction schedules.
 - l. Work beyond Contract Limit.
 - m. Procedures for testing and inspection.
 - n. Procedures for maintaining record documents.
 - o. Requirements for equipment start-up.
 - p. Inspection and acceptance of equipment put into service during construction period.

1.9 PRE-INSTALLATION/PRE-FABRICATION CONFERENCES

- A. When required in individual specification sections, prior to commencing the work of that trade, convene a pre-installation conference at work site, if possible, on same day as weekly progress meeting.
- B. Notify Architect, Duxbury Senior Center director or designated representative and Owner's Project Representative a minimum of one week in advance of meeting date.

July 11, 2018

- C. Attendance is required by Contractor's Project Manager and Superintendent, and parties directly affecting, or affected by, work of the Section.

1.10 COORDINATION MEETINGS

- A. In addition to other specified meetings and additional meetings as required. General Contractor shall hold project coordination meetings, at least monthly at regularly scheduled times. Hold meetings more frequently when necessary to ensure full coordination of work. Request representation at each meeting by every entity involved in coordination or planning for work of the entire project. Conduct meetings in a similar manner to progress meetings, to resolve coordination problems.
- B. Keep minutes of coordination meetings and distribute copies to all attendees, related parties and to Owner, Resident Project Representative(s), Architect and its engineering consultants within 3 business days following meeting. Coordination meetings shall continue on an appropriate schedule, even after completion of coordination drawings by Contractor, to review progress and resolve minor conflicts not identified in the coordination drawings.
- C. The following trades shall participate in coordination meetings, preparation of coordination drawings and reviews. Additional trades shall participate as the Contractor deems necessary for proper coordination of the Work.
 - 1. Concrete work.
 - 2. Structural steel, light gage metal framing and metal fabrications.
 - 3. Rough carpentry.
 - 4. Air and vapor barrier work.
 - 5. Finish wall and ceiling construction.
 - 6. Fire protection systems.
 - 7. Plumbing systems, including roof drainage, waste and vent systems and distribution.
 - 8. HVAC systems including, piping, ductwork, equipment, controls, appurtenances and equipment.
 - 9. Electrical lighting, power, communications and signaling, fire detection and related systems.
 - 10. Excavation, site utilities and site improvements.
- D. All adjustments necessary to achieve full coordination shall be determined in a timely manner, so as not to delay the work. Include time necessary for consideration by the Architect and Resident Project Representative(s) for proposed modifications. No claim for additional compensation for extension of time arising from delays due to failure of Contractor to identify potential conflicts requiring coordination in a timely manner or from additional work made necessary by such failure will be valid.

1.11 PROGRESS MEETINGS

- A. The Architect or its representative will administer meetings throughout the progress of the Work; make arrangements for meetings, prepare agenda with copies for participants, preside at meetings, record minutes and distribute copies within one

week to Contractor, Owner and participants of meeting only. Contractor is responsible for distribution to subcontractors, vendors, suppliers and others who are affected by decisions made.

1. Scheduled Frequency of Meetings: Bi-weekly (once every two weeks).
2. The General Contractor is responsible to arrange Filed-Subcontractors, subcontractors, vendors and suppliers to attend progress meetings, coordinated by intended meeting agenda.

B. Attendance: Required are Contractor's Project Manager and Project Superintendent, and each Filed-Subcontractor, applicator, installer, and supplier whose work is on-going or scheduled. Owner, Architect, engineering consultants, and other persons are required to attend as the Architect may direct. Subcontractors, vendors, suppliers shall be present at meetings upon request of Contractor.

1. Attendee Authority: Subcontractors and supplier representatives present at meetings shall have authority to act for and make commitments for, the entity which they represent.
2. Restricted Attendance: Owner and Architect reserve the right to expel or exclude from any Progress Meeting any person(s) or company representative(s) without statement of reason or excuse.
3. Attendance of Architect's Consultants: Contractor shall make an attendance request for specific Architect's consultants and engineers at least 72 hours in advance of the meeting. Clearly identify In the request all consultant related issues and topics to be discussed at the meeting. The Architect will decide if its consultant or engineer will attend.
4. Attendance of Owner's Independent Consultants: Contractor shall make an attendance request for specific Owner's consultants at least 72 hours in advance of the meeting. Clearly identify In the request all consultant related issues and topics to be discussed at the meeting. The Owner will decide if its consultant(s) will attend.

C. Items of Agenda:

1. Review minutes of previous meetings.
2. Review of Work progress.
3. Field observations, problems, and decisions.
4. Identifications of problems which impede planned progress.
5. Review of submittals schedule and status of submittals.
 - a. Review of environmental/sustainability-related submittals, schedule and status.
6. Review of off-site fabrication and delivery schedules.
7. Maintenance of progress schedule.
8. Corrective measures to regain projected schedules.
9. Coordination of projected progress.
10. Maintenance of quality and work standards.
11. Progress of Work to be adjusted under coordination requirements, and effect of proposed changes on progress schedule and coordination.

12. Other business relating to Work.

1.12 SPECIAL PROJECT MEETINGS AND BUILDING COMMITTEE MEETINGS

- A. Special project meetings: The Contractor shall conduct special project meetings as required throughout the course of the Work. Special Project Meetings are those held in addition to the regularly scheduled progress meetings. The Architect and Owner are not required to attend these meetings. Special meeting issues include, but are not limited to:
1. Safety issues.
 2. Labor issues.
 3. Special scheduling and phasing issues.
- B. Additional Special Meetings requested by the Architect or Owner: The Contractor along with any requested or necessary Filed-subcontractors, subcontractors, applicators, vendors or material suppliers shall attend additional meetings when requested by the Architect or Owner as they deem necessary. Such meetings may be convened on short notice if conditions at the project site so require and attendance is mandatory. The Architect and Owner are not limited as to the number of additional meetings that may be requested, or the agenda for such meetings.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

End of Section

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Section 01 32 00
CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Survey and layout data.
- B. Scheduling of the Work.
- C. Contract progress reporting.
 - 1. Construction schedule updates.
 - 2. Daily construction reports.
 - 3. Look ahead activity reports.
 - 4. Special Reports - Unusual Event Reporting.
- D. Work Documentation:
 - 1. Periodic site observations.
 - 2. Construction progress photographs.

1.2 SURVEY AND LAYOUT DATA

- A. Prior to starting any construction work, stake out all limits of cut and fill, the limits of proposed walkways and site improvements. Promptly upon completion of layout work and before any construction work is begun on the site, notify the Architect and Designated Owner's Representative, who shall conduct a field inspection of the stakeout. The Architect reserves the right to adjust the location of such layouts as it deems necessary to comply with the intent of the Contract Documents.

1.3 SCHEDULING OF THE WORK

- A. Submit Gantt/Bar progress schedule in triplicate within 15 days after date of Owner-Contractor Agreement for Architect's review. Revise and resubmit as required.
- B. Schedule shall be of format approved by Architect showing complete sequence of construction activity, identifying Work of separate stages and other logically grouped activities. For each separate phase, stage of Work and individual activities, indicate the early and late start dates, early and late finish dates, float dates, and duration.
 - 1. The Schedule shall show the sequence and phasing of activities required and reflect the manner in which actual work will be performed. The number of activities shown in the Schedule must be at least equal and related to the number of items listed in the Schedule of Values including back-up detail.
 - 2. Indicate implementation and termination of each temporary utility.
 - 3. Define portions of work which are dependent on the schedule of other related activities and phasing.
 - 4. Define activities on which the work is dependent, including:

- a. Submittal of shop drawings, equipment schedules, samples, color submission, coordination drawings, templates, fabrication and material delivery times.
 - b. Architect/Engineer's review of shop drawings, equipment schedules, samples and templates.
 - c. Delivery times of equipment furnished under separate Contracts with Owner, where the Contractor has responsibility for installation or coordination.
5. Conclude all activities on one common end date, show contract completion date as a milestone activity on the Schedule.

1.4 CONTRACT PROGRESS REPORTING

A. Construction schedule updates:

1. During progress of Work, revise and resubmit with Applications for Payment in accordance with the provisions of the General Conditions and Supplementary Conditions.
2. Maintain progress schedule with project progress and utilize the plan in planning, coordinating and performing the work under this Contract.
3. Furnish copies of the Progress schedule, and revisions, to all subcontractors, installers, equipment vendors and suppliers.
4. Update schedule showing actual progress of Work in progress, identify Work started and completed during the previous update period. Show the estimated time required to complete each activity started but not yet completed, and reflect any changes in the schedule.
5. Prepare a Schedule Analysis for submission with revised project schedules. The Schedule Analysis shall include a description of problem areas, current and anticipated delaying factors and their estimated impact on performance of other activities and completion dates, and an explanation of corrective action to be taken. All activities that are behind schedule by more than two weeks shall be addressed individually in the Schedule Analysis.
6. Submit revised schedules with attached Schedule Analysis, with each Application for Payment; clearly identify changes since previous version. Indicate estimated percentage of completion for each item of Work at each submission.

B. Daily construction reports: Prepare a daily construction report, submit duplicate copies to the Architect at weekly intervals. Record the following information concerning events at the site:

1. List of subcontractors at the site, and approximate count of personnel.
2. Accidents, unusual events, and emergency procedures.
3. High and low temperatures, general weather conditions (when exterior work is in progress).
4. Meetings and significant decisions.
5. Stoppages, delays, shortages, losses.
6. Emergency procedures.
7. Orders and requests of governing authorities.

8. Change Orders received, and implemented.
 9. Services connected, disconnected.
 10. Meter readings and similar recordings.
 11. Equipment or system tests and start-ups.
 12. Partial Completions/occupancies.
 13. Substantial completions authorized.
- C. Look ahead activity reports: Prepare each week throughout the term of construction a listing of upcoming construction activities. Each weekly report shall include a listing of planned construction activities for the upcoming 2 weeks (14 calendar days). Submit a Look Ahead Activity Report at each job meeting to all participants. If no meeting is planned on a given week, mail the reports directly to both Architect/Engineer and Owner's Project Representative.
1. Maintain a record of all Look Ahead Activity Reports in a 3-ring binder in the Contractor's field office and make available for review by Architect/Engineer and Owner's Project Representative.
- D. Special Reports:
1. Unusual Event Reporting: When an event of an unusual and significant nature occurs at Project site, whether or not related directly to the Work, prepare and submit a special report. List chain of events, persons participating, response by Contractor's personnel, evaluation of results or effects, and similar pertinent information.
- 1.5 WORK DOCUMENTATION - PERIODIC SITE OBSERVATIONS
- A. Observe and maintain a record of tests. Record the following:
1. Specification section number, product(s), and name of subcontractor or installer.
 2. Name of testing agency and name of inspector.
 3. Name of manufacturer's representative present.
 4. Date, time and duration of tests.
 5. Type of test and results.
 6. Retesting required.
- B. Observe startup and adjustments; record time and date of equipment start-up and results.
- C. Observe equipment demonstrations to Owner; record times and additional information required for operation and maintenance manuals.
- D. Assist Architect/Engineer with final inspections. Prepare list of items to be completed and corrected.
- 1.6 WORK DOCUMENTATION - CONSTRUCTION PROGRESS PHOTOGRAPHS
- A. Furnish digital photographs of site and construction throughout the progress of Work, produced by a photographer acceptable to Architect.
1. Submit photographic submittals on Discs: 2 copies, per submission.

- a. Progress photographs, submit monthly and at final project completion.
- B. Views: Take photographs from differing directions indicating the relative progress of the Work. Take photographs monthly on date for Application of Payment, and at final completion.
1. Prior to start of demolition work and site clearing take one set of exterior and interior photographs showing existing conditions.
 2. As a minimum each month during the Work, furnish the following number of views (as appropriate to Work being performed):
 - a. Views of site construction: 4.
 - b. Exterior views of building: 4.
 - c. Interior views: 6, each floor.
 3. Take additional photographs for the following major portions of work:
 - a. Start and completion of site preparation.
 - b. Completion of hazardous material abatement.
 - c. Completion of excavations, prior to form work or footings.
 - d. Completion of demolition.
 - e. Completion of foundations.
 - f. Each stage of completion of structural framing.
 - g. Enclosure of building.
 - h. Provide 3 roof top photographs each month during roofing work, plus another 3 at completion of roofing and flashing work.
- C. Submission of Discs: Identify each disc on the back with the following information:
1. Project identification.
 2. Date and time of exposure , and orientation(s) of view.
 3. Photographer's name, address and phone number.
- D. Submission of Prints: if requested shall be furnished a prevailing commercial rates.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

End of Section

Section 01 33 00
SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Submittal coordination.
- B. Submittal procedures and grading.
- C. Schedule of Submissions.
- D. Owner's environmental policy submittals.
- E. Shop drawings, product data and samples.
- F. Manufacturer's instructions.
- G. Manufacturer's certificates.
- H. Emergency addresses.
- I. Erosion and sediment control program.

1.2 SUBMITTAL COORDINATION

- A. General: The Contractor is fully responsible for delay in the delivery of materials, progress of the Work and damages incurred due to Contractor's failure to submit, revise and resubmit submissions in accordance with the requirements herein, and in a coordinated and timely manner.
- B. Make submittals in a proper and timely fashion, allowing for administrative procedures, Architect's review, corrections to submissions and resubmittal, if necessary, and fabrication of products without delaying the project. Minimum processing times required by the Architect are as follows:
 - 1. Review for Architect's Office only: Allow a minimum of 10 working days for review and processing. Some submittals may require additional time.
 - a. Simultaneous submission of a large number of shop drawings and product data may require longer than 10 working days for review. (In particular submittals for Divisions 3, 5, 6, 21, 22, 23, 25 and 26).
 - b. Complex Systems (structural, mechanical, electrical) may require longer than 10 working days for review each time shop drawings, layout drawings, and product data are submitted or resubmitted.
 - 2. Review by Architect and its consultant(s): Allow 10 working days for review and processing of submittals by Architect plus an additional 5 working days for review by each consultant as applicable.
 - 3. Reprocessing of submittals: For submittals requiring resubmittal, re-processing time required shall be the same as first submittal.
 - 4. No extension of Contract Time will be authorized due to failure to transmit submittals sufficiently in advance of scheduled performance of Work.

July 11, 2018

- C. Make submittals of similar items, systems, or those specified in a single specification section together.
- D. Make submittals for products which other products are contingent upon, first.
- E. The Contractor is fully responsible for delay in the delivery of materials or progress of work caused by late review of shop drawings due to failure of the Contractor to submit, revise, or resubmit shop drawings in adequate time to allow the Architect checking and processing of each submission or resubmission.

1.3 SCHEDULE OF SUBMISSIONS

- A. Schedule procedure: Immediately after being awarded the Contract, meet with the Architect to discuss the schedule of submissions and then prepare and submit within 21 calendar days for approval a schedule of submissions for the Work. The schedule of submissions shall be related to the entire Project, and shall contain the following:
 - 1. Shop Drawing Schedule (for shop and setting drawings to be provided by the Contractor).
 - 2. Sample Schedule (for samples to be provided by the Contractor).
 - 3. With respect to portions of the Work to be performed by Subcontractors, such schedule of submissions for the work of each Subcontractor shall be submitted for approval within 30 calendar days after execution of a subcontract with such Subcontractor.
- B. List all submissions required of each trade:
 - 1. Include the Specification Section number, name of subcontractor or vendor, submittal type, item, description, type, quantity and size (where applicable) of each submission.
 - 2. For each submission, provide the following dates, as estimated:
 - a. Scheduled date of submission.
 - b. Required date of approval. (permit time for appropriate review and resubmissions as may be required).
 - c. Estimated date of beginning fabrication or manufacture of product (where applicable).
 - d. Required date of submission of product to testing laboratory.
 - e. Required date of testing laboratory approval.
 - f. Required date for delivery of product to site.
 - g. Required date for beginning of installation of product.
 - h. Required date for completion of installation (and in-place testing).
 - i. Required dates for documentation as indicated in Section 01 78 00 – CLOSEOUT SUBMITTALS.
 - 1) Project record documents.
 - 2) Project record drawings.
 - 3) Required date for operation and maintenance data and preventative maintenance instructions.
 - 4) Materials and finishes manuals.
 - 5) Warranties and bonds.

July 11, 2018

- 6) Maintenance contracts.
- 7) Spare parts and maintenance materials.
- C. For each submittal, schedule to allow adequate time for review by the Architect and its consultants. The Architect will not be responsible for Work performed in shop or field prior to approval. Long-lead items requiring expedited action must be clearly indicated.
 - 1. The schedule shall be reviewed and resubmitted as necessary to conform to approved modifications to the construction Project Schedule, and shall be updated as may be required by the Architect.
- D. Posting of submittal schedule: Print and distribute the submittal schedule to Architect, Owner, subcontractors and other parties affected. Post copies in field.
- E. Update schedule throughout progress of the Project, coordinated with scheduling changes in the Work, and redistribute monthly in conjunction with submittal of Application for Payment.

1.4 OWNER'S ENVIRONMENTAL POLICY SUBMITTALS

- A. Schedule: Immediately after being awarded the Contract, meet with the Architect and Owner's Representative to discuss the schedule of environmental policy submissions and then prepare and submit within 14 calendar days for approval a schedule of submissions related to the Owner's Environmental Policy.
 - 1. The "Schedule of Environmental Submissions" shall be related to the entire Project, including commissioning, and as a minimum contain the following items.
 - a. Construction Indoor Air Quality (IAQ) plan.
 - b. Manufacturer's product information and MSDS sheets.
 - 2. Update schedule throughout progress of the Project, coordinated with scheduling changes in the Work, and redistribute monthly in conjunction with submittal of Application for Payment.

1.5 SUBMITTAL PROCEDURES AND GRADING

- A. Prepare and submit to the Architect, all specified and requested submittals.
- B. Provide space for Contractor, Architect and engineering consultant review stamps, on the front page of each item's submittal copy. Apply Contractor's stamp, signed or initialed certifying that review, verification of products required, field dimensions, adjacent construction Work, and coordination of information, is in accordance with the requirements of the Work and the Contract Documents. The Architect's stamp shall contain the following data (Engineering consultant review stamps may vary in language, but intent of language is similar):
 - _____ REVIEWED AND APPROVED.
 - _____ REVIEWED AND APPROVED, EXCEPT AS NOTED.
 - _____ RESUBMISSION REQUIRED
 - _____ DISSAPPROVED
- 1. The Architect will insert the date of action taken and an identification of the person taking the action.

2. Submittal grading:
 - a. REVIEWED AND APPROVED - No corrections, no marks.
 - b. REVIEWED AND APPROVED, EXCEPT AS NOTED - Minor corrections required are as noted; all items can be fabricated as noted, without further correction and resubmission of original submission; checking is complete and all corrections are deemed obvious without ambiguity.
 - c. RESUBMISSION REQUIRED - Resubmission is required; checking may be incomplete; details of items noted by checker are to be clarified further before full review can be given. Correct and resubmit, do not fabricate noted items requiring correction.
 - d. DISSAPPROVED - Submittal is rejected as not in accord with the Contract Documents, too many corrections, or other justifiable reasons. When returning submission, Architect will state reasons for rejection. Correct and resubmit, do not fabricate.
 3. Review/approval neither extends nor alters any contractual obligations of the Architect, Engineer or Contractor.
- C. Identify all variations from Contract Documents, and product or system limitations which may be detrimental to successful performance of the completed work.
- D. Contractor's review: Review all shop drawings, product data and samples. Include, without limitation, verification of the following:
1. Proper title, original date, drawing number (which shall be changed if resubmitted), revision numbers and dates, designation of project contractor, subcontractor and/or supplier.
 2. Identification of Shop Drawings, Product Data or Samples by Specification Section and subsection or paragraph where appropriate and identification of Contract Drawings by number and detail.
 3. On each submittal, as a minimum, Contractor shall identify the following:
 - a. Errors, inconsistencies, and omissions discovered in the contract documents and field conditions must be reported at once to the Architect.
 - b. Any variations from code requirements contained in the contract documents must be reported promptly in writing to both the Architect and Owner.
 - c. Promptly report to the Architect information that any design, process, or product infringes on a patent.
 - d. Names of subcontractor(s) and supplier(s). Include name(s) of contact person(s), address, telephone and fax number(s).
- E. Revise and resubmit submittals as required, identify all changes made since previous submittal. Distribute copies of reviewed submittals to concerned parties; instruct parties to promptly report any inability to comply with provisions.
- 1.6 SUBMISSION REQUIREMENTS AND QUANTITIES
- A. Furnish Architect with electronic files through the Adobe Acrobat Portable Document Format (PDF) files for each of the following submittal types:
1. Schedules, including, but not limited to:
 - a. Construction Schedule.

- b. Schedule of Values.
 - c. Schedule of shop drawings, product data, and samples.
 - d. Schedule of Environmental Submissions.
2. Shop drawings.
 3. Product data, manufacturer's instructions and certificates and similar submissions.
 4. Erosion control program.
 5. Environmental policy (sustainable design) submittals.
 6. Emergency addresses: 1 file to Architect, and 1 file direct to Owner.
- B. Furnish Architect with the following quantities of the following physical submittals:
1. Samples: Sets of 3 identical samples of each submission required.
- C. General submission of physical submittals.; deliver to Architect at the following address:
- Winslow Architects, Inc.
89 Massachusetts Avenue
Arlington, Massachusetts 02476
- D. Transmit submittals to Architect at the above address, with individual transmittal forms, Document 00 62 12 – PRODUCT SUBMITTAL FORM for each submission. Document 00 62 12 is bound into the Project Manual; unbound copies are available from the Architect.
1. On transmittal form, identify Project, Contractor, subcontractor, installer, or supplier, pertinent Drawing sheet and detail number(s), and specification Section number, as appropriate. Transmittals received by the Architect from sources other than the Contractor will be returned without any action taken.
 2. Contractor shall number submittals sequentially by Specifications Section prior to submittal. Resubmitted items shall retain number and be noted as resubmitted (example 260000-1 R1).

1.7 SHOP DRAWINGS

- A. General: Provide accurately prepared, large scale and detailed shop drawings prepared specifically for this Project. Shop drawings shall include fabrication and installation drawings, setting diagrams, schedules, patterns, templates and similar drawings. Standard information prepared without specific reference to Project are not considered shop drawings.
1. Show adjacent conditions and related work. Show accurate field dimensions where appropriate.
 2. Identify materials and products shown. Note all conditions where require coordination with other trades and special installation procedures.
 3. Show gage and thickness of materials.
 4. Indicate welding details and joint types.
 5. Show every component of fabricated items, notes regarding manufacturing process coatings and finishes, identifying numbers conforming to the Contract Documents (i.e. stair numbers, door numbers and similar items), dimensions, and appropriate trade names.

6. Show anchorage and fastening details, including type, size and spacing.
 7. Review each submittal for conformity with the Contract requirements prior to submittal, certify such review on each shop drawing with Contractor's stamp, signature and date. Reference on shop drawings to other sections, installers, suppliers, or trade(s) shall designate the appropriate specification sections, and the term "by others" shall not be used.
- B. Size of Format: Not less than 8-1/2 by 11 inches, and no larger than 30 by 42 inches, except for templates, patterns and similar full-size drawings.
 - C. The Architect's comments and corrections will be made on the electronic submission (PDF) and returned to the Contractor. If necessary, the Contractor then shall make the necessary corrections on the original drawings and resubmit the corrected drawings in electronic format (PDF) as specified. Prints of any submittals required for the Architect's own use, and those of engineering consultants, will be made without cost to the Contractor. The Contractor is responsible to distribute and furnish (at no additional cost to Owner) all shop documents needed for use by the Contractor, subcontractors, installers, vendors and suppliers.
 - D. Drawing submittals returned "REVIEWED AND APPROVED" or "REVIEWED AND APPROVED, EXCEPT AS NOTED" Obtain and distribute adequate prints for construction, including one print of each for designated Owner's and Architect's Project Representative(s), and then return the originals to the subcontractor or supplier from whom he originally received them.
 - E. Drawing submittals returned "RESUBMISSION REQUIRED" or "DISSAPPROVED": Contractor shall first obtain a record print and then forward them to source for correction of original drawings. Resubmit corrected documents in same manner as first submission.
 - F. Each drawing shall have a title block on the right hand side containing the following data:

Name of project -	POPE'S TAVERN ADDITION/RENOVATION
Architect -	Winslow Architects, Inc.
Contractor -	
Subcontractor/supplier -	
Date of submission -	

- G. Each drawing shall have a clear space on the right hand side for review stamps of both the Architect and Contractor.
 1. The Contractor's Review and Action Stamp: Provide suitable space on label or title block for Contractor's review and action stamp. Stamp and sign each submittal to show Contractor's review and approval prior to transmittal Architect. Submittals not signed and stamped by Contractor will be returned without action.
 - a. Only submittals received from the General Contractor will be considered for review by the Architect. Contractor shall review each submittal for accuracy and conformance with the requirements of the Contract Documents, and particularly for field measurements and proper fit with adjoining work. Modify submittals as required to show interface with adjacent work and attachment to Building.

- b. The Contractor's Review and Action Stamp shall contain the following language or similar:

<p style="text-align: center;">APPROVED FOR CONFORMANCE WITH THE CONTRACT DOCUMENTS.</p> <p>All dimensions and quantities have been reviewed and are accepted by _____</p> <p style="text-align: center;"><i>General Contractor's Name</i></p> <p>All dimensions and field conditions have been or will be verified prior to fabrication of the items described herein.</p>

- c. Submittals received from the Contractor shall be signed and comply with review requirements. Submittals not certified or improperly certified (stamped but not reviewed) will be returned to the Contractor without Architect's review. Claims due to the return of uncertified, improperly prepared or inadequately reviewed submittals will be rejected.

1.8 PRODUCT DATA

- A. Submit Product data as specified, and as the Architect may additionally prescribe. Product data includes, but is not limited to:
1. Catalog cuts.
 2. Complete specifications.
 3. Standard color charts.
 4. Performance data.
 - a. Compliance with recognized trade association standards.
 - b. Compliance with recognized testing agency standards, labels and seals.
 5. Environmental data including, but not limited to:
 - a. Chemical composition.
 - b. Recycled (pre and post consumer) content.
 - c. Locations of material extraction/harvest and manufacture, with respective distances to site.
 - d. VOC content.
 - e. Material certifications as applicable to product.
 6. Certified laboratory test report data.
 7. Health and safety precautions.
 8. Illustrated capacities, characteristics, wiring diagrams, controls, and other pertinent information for complete product and product use description.
- B. If more than one size or type is shown on any printed sheet, indicate clearly intended item(s).

1.9 SAMPLES

- A. Submit samples clearly labeled as to its material, type or make, manufacturer, size or gauge, and other pertinent data, accompanied by an appropriate transmittal form. Samples shall show full range of color and texture variation that can be expected.

July 11, 2018

1. When accepted or not accepted, the Architect will retain one set of samples and return the other to the Contractor. Samples will not be permitted for use in the project.

1.10 MANUFACTURER'S INSTRUCTIONS

- A. When specified in individual specification Sections, submit manufacturer's printed instructions for delivery, handling, storage, assembly, installation, start-up, adjusting, and finishing.
- B. Identify conflicts between manufacturer's instructions and Contract Documents.

1.11 MANUFACTURER'S CERTIFICATES

- A. When specified in individual specification Sections, submit manufacturer's certificates and installer certificates to Architect for review.
- B. Indicate material or product conforms to or exceeds specified requirements. Submit supporting reference date, affidavits, and certifications as appropriate.
- C. Certificates may be recent or previous test results on material or product, but must be acceptable to Architect.

1.12 EMERGENCY ADDRESSES

- A. Within 15 days of Notice to Proceed, submit in writing, the name, addresses and telephone numbers of key members of their organization including Contractor's Superintendent and personnel at the site, to be contacted in the event of emergencies at the building site, which may occur during non-working hours.

1.13 EROSION AND SEDIMENT CONTROL PROGRAM

- A. Submit erosion and sediment control program within 30 days after date of Owner-Contractor Agreement for Architect's review. Revise and resubmit as required.
- B. Erosion and sediment program shall indicate proposed methods, materials to be employed, and schedule for effecting erosion and siltation control and preventing erosion damage. Provide sufficient information to fully explain the program; the following are the minimum requirements:
 1. Proposed methods for actuating erosion and siltation control including 1 inch equals 40 feet (1"=40') scale plans indicating location of erosion control devices and siltation basins.
 2. List of proposed materials including manufacturer's product data, in accordance with Division 31 - EARTHWORK and Division 33 - EXTERIOR IMPROVEMENTS.
 3. Schedule of and sediment control program indicating specific dates from implementing programs in each major area of Work.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

End of Section

Section 01 35 16
ALTERATION PROJECT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Special requirements and considerations for renovation and alternation work including, but not limited to, the following:
 - 1. Special requirements for temporary protection of existing finishes and building components.
 - 2. Transitions and adjustments.
 - 3. Procedural requirements for Alterations.
 - 4. Repair of damaged surfaces, finishes, and cleaning.
 - 5. General requirements for rehabilitation and renovations of existing spaces and materials.

1.2 RELATED REQUIREMENTS

- A. Section 01 73 29 - CUTTING AND PATCHING: Procedural and administrative requirements for cutting and patching.
- B. Section 02 41 19 - SELECTIVE DEMOLITION: Demolition of selected portions of the building for new construction.

1.3 GENERAL RENOVATION REQUIREMENTS

- A. General: The work required by the Contract Documents includes alterations and renovation of existing construction.
- B. Rework, rebuild, and repair existing construction and surfaces to eliminate damaged and deteriorated materials and construction, and to create continuous "like new appearance and conditions":
 - 1. At each interface between new and existing work.
 - 2. Where damage or holes are caused by installation of new work.
 - 3. At each location of demolition and removal of existing work.
 - 4. Wherever the Contract Documents indicate work on existing surfaces.
 - 5. At all existing construction and surfaces to remain except those specifically noted as "No Work Required".
- C. All items required to be moved to facilitate work shall be carefully carried or conveyed.
- D. Use qualified personnel for alteration and restoration work.
- E. Protect and maintain existing finishes, surfaces, and substrates indicated to remain, indicated to remain "with specific cleaning", or indicated to remain "with new finishes".
- F. Protect existing surfaces from damage, vandalism, graffiti, impressions, marks, and defects.

July 11, 2018

- G. Locate protection where it will serve the project adequately and result in minimum interference with performance of the work.
- H. Protection may be required to remain in place for the duration of the project. As such, materials should be installed to provide adequate protection throughout the full extent of construction activities. Repair or reinstall protection throughout the duration of construction as required.
- I. Renovation Work Patching: Comply with requirements indicated throughout the Contract Documents for each type of patching, repair, and finish work.

1.4 PROTECTION OF OCCUPIED AREAS

- A. General requirements for work activities in Owner and public occupied areas are as follows:
 - 1. Notify the Owner and obtain his approval at least 48 hours, or greater if requested by the Owner, prior to commencing work.
 - 2. Provide dust and airborne contaminant control measures in accordance with procedures specified under Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS, and commensurate with level of contaminant control as directed by the Owner.
 - 3. If work must be performed in occupied area(s), protect existing surfaces to provide a safe working platform and surfaces from falling debris. Take all necessary precautions to protect the people and spaces below from injury.
 - 4. When working with fluids provide a water-tight barrier beneath the work area to catch and retain all spillage.

1.5 CEILING ACCESS REQUIREMENTS IN OCCUPIED AREAS

- A. Notify the Owner and obtain his approval for work requiring access to the ceiling in Occupied Areas at least 48 hours before work is to begin.
- B. If required by the Owner, comply with the following procedures.
 - 1. Work Tag Procedure:
 - a. Attach a completed, approved work tag on the ceiling access area before work can proceed.
 - b. The work tag can be removed only after the work is done and clean up is completed.
 - c. All tags issued from Owner shall be returned the same day to the office at which it was issued, after work and cleanup for the day has been completed.
 - 2. Spray top ceiling panels to be removed, and surrounding affected panels, with the fine water mist to settle dust prior to removal.
 - 3. Inform Owner so that room doors near ceiling work will be kept closed while the work is in progress.
 - 4. Owner shall be contacted for all ceiling access problems.

July 11, 2018

1.6 SUBMITTALS

- A. Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
 - 1. Shop drawings: Show extent and location of temporary protection of existing building elements and finishes. Existing construction drawings may be used as base sheets for shop drawings.
 - 2. Proposed methods of protection for review and approval prior to the commencement of work.

1.7 REFERENCES

- A. Referenced Standards: Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
 - 1. ANSI A 10 - Safety Requirements for Construction and Demolition.
 - 2. NFPA 241 - Building Construction and Demolition Operations.
 - 3. ANSI-A10 Series standards for "Safety Requirements for Construction and Demolition".

1.8 QUALITY ASSURANCE

- A. The General Contractor is responsible for protection of all existing materials and components to remain or to be salvaged. In the event of damage, such items shall be immediately repaired or replaced by the Contractor, at his expense, to the satisfaction of the Architect.
- B. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and methods needed for proper performance of work in this section.
- C. The Contractor is hereby directed to recognize the value and significance of the building, and exercise special care during all phases of the work to ensure that the existing building, its details, materials and finishes which are to remain or to be salvaged are not damaged by the work being performed.
- D. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with specified requirements and methods needed for proper performance of the work of this Section.

1.9 PROJECT CONDITIONS

- A. Do not allow hazardous dangerous or unsanitary conditions, or public nuisances to develop or persist on the site.
- B. Protections shall remain in place for the duration of the project unless determined otherwise by the Architect.

July 11, 2018

- C. Coordinate the performance of work of this section with related or adjacent work. Protection of items should be complete prior to commencement of demolition and construction.

1.10 SEQUENCING AND SCHEDULING

- A. Conduct alteration and restoration work in a manner giving prime consideration to protection of the public; protection from the weather, control of noise, shocks and vibration; control of dirt and dust; orderly access for and storage of materials; protection of existing buildings; protection of adjacent surfaces and property; coordination and cooperation with the Owner at all times.
- B. Comply with all requirements of this contract relative to protection, scheduling and coordination with the Owner.
- C. Coordinate and arrange with mechanical and electrical trades for their disconnecting, rerouting and maintenance of existing services in the buildings as required, as part of the work of this Contract.
- D. Coordinate the mechanical work that may extend into adjacent occupied spaces, such as the floors above and below, so as to minimize disruption to the Owner's operations.
- E. Adhere to approved locations for trash chutes, routes to be used by workers, use of elevators, and areas for storage of materials.
- F. Provide necessary protection to completely cover all remaining adjacent surfaces, existing equipment, furniture and furnishing during demolition and construction operations.
- G. Sequence alteration work to provide minimal disruption to the facility's normal operations while isolating construction activities from the Owners personnel. All coordination and implementation of sequencing shall be at no additional cost to the Owner.
 - 1. Work Schedule: Provide a detailed schedule of construction work. The schedule established shall provide for minimal disruption to the facility's normal operations while isolating construction activities from the Owner's personnel.
- H. Work in Occupied Area:
 - 1. The abutting areas of the project will be occupied during the construction period. Perform all work in such a manner as to prevent interference with the Owner's operation of the facility.
 - 2. Work which, in the opinion of the Owner, will interrupt or prevent any function of the Owner's operation of the facility may be required to be performed during off hours, with prior written approval of the Owner.
 - 3. Where work occurs in Owner occupied areas, refer to Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS for protection requirements.
 - 4. At the end of work operations in the occupied area, remove all protective coverings and all work materials. Remove all debris and thoroughly clean the area, leaving it ready for Owner's use.

- I. Equipment Access: Provide access for all large scale equipment furnished and installed under this contract. Should existing openings require enlargement, enlarge same and replace to former condition.

1.11 STORAGE OF CONTRACTOR'S MATERIALS, TOOLS AND EQUIPMENT

- A. There shall be no storage of materials, tools, and equipment within any of the occupied areas.
- B. Only materials, tools and equipment intended and necessary for immediate use shall be brought into the occupied areas. At the end of each work day and at the completion of each phase of work, equipment and leftover or unused materials shall be removed.
- C. Storage of equipment and materials outside of the Contractor's construction zone must be authorized by the Owner.

PART 2 – PRODUCTS

2.1 PRODUCTS FOR PROTECTION

- A. General: Materials used for protection of existing finishes and surfaces: sound materials and of adequate dimension for the intended use. Temporary protection materials shall be properly supported, braced, tied, and arranged to ensure absolute safety for those using the equipment and sufficient to safely withstand all loading and stress.
 - 1. Temporary protection shall not puncture, scar, or damage walls or other finish construction.
- B. Lumber and Plywood:
 - 1. Lumber: Hem-Fir, Douglas Fir, Eastern Spruce, Eastern Hemlock, or Southern Pine, surfaced dried stud or utility grade.
 - 2. APA graded C-D-X EXT, Group 2 species, thickness as required.
- C. Wood fiber board, equal to Homasote Company, Trenton NJ., product "HCFR Homasote", 4 by 8 foot panel, 1/2 inch thick.
- D. Dust Caps: Block off all existing ventilation ducts within the construction area. Method of capping ducts shall be dust tight and withstand airflow.
- E. Polyethylene: Polyethylene (for protection of surfaces in Occupied Areas) shall be 6 mil fire retardant type listed by Fire Underwriter's Laboratories, Griffolyn #T55R or Star-Tex of Lakeville, MN, 55044 with Griffolyn fire retardant tape, or equal.
- F. Protection paper: Canadian red-rosen paper or kraft paper.
- G. Accessories: Provide necessary and related parts, devices and anchors required for complete installation.

2.2 PRODUCTS FOR PATCHING AND EXTENDING WORK

- A. General: Provide new materials. If acceptable to the Architect, undamaged previously used materials in serviceable condition may be used. Provide materials suitable for the use intended.

July 11, 2018

- B. New Materials: As specified in individual Sections, match existing products and work for patching and extending work.
- C. Determine type and quality of existing products by inspection and any necessary testing, and workmanship by use of existing as a standard. Presence of a product, finish, or type of work, requires that patching, extending, or matching shall be performed as necessary to make Work complete and consistent with existing quality.

2.3 EQUIPMENT

- A. Existing Equipment Designated To Be Relocated: Relocate existing fixed equipment designated to be relocated.
 - 1. Disconnect and reconnect existing relocated equipment to building services.
 - 2. Make all terminal connections to the mechanical and electrical services.
 - 3. Receive, check and place equipment in designated position.
 - 4. A schedule of room locations of the items of existing equipment will be furnished by the Architect.

PART 3 – EXECUTION

3.1 PROTECTION OF EXISTING BUILDING FINISHES AND COMPONENTS

- A. General: Provide temporary enclosure for protection of construction in progress and completed, from exposure, foul weather, other construction operations and similar activities.
 - 1. Provide all temporary protection, including planking, barricades, signs, necessary to protect personnel and the public from equipment and construction operations. Take all required measures to protect the existing building (contents, surfaces, or materials) and site from damage of any kind when performing the Work.
- B. Existing Building Elements to Remain:
 - 1. Interior finishes must be physically isolated from construction operations by means of protective barriers and coverings.
 - 2. Protect all existing building elements to remain in place which may be damaged by construction activities. In the event of new damage, inform the Architect immediately as to the nature and extent of damage and the proposed method of repair.
 - 3. Do not attach protection materials directly to existing finished surfaces which might be damaged by such attachment. Do not use duct tape or mechanical fasteners on existing finished materials unless so directed by Architect.
 - 4. Protection to be secured adequately so as to maintain a safe environment for workers and other individuals using the building throughout the duration of the project.
 - 5. Provide all temporary protections as may be required to ensure that all components of existing building indicated to remain are not damaged during the execution of the Work.
 - 6. Closed Areas: Closed areas shall be those rooms where access is not required for construction activities. These rooms shall be locked at the outset

- of construction for protection from construction activities, and shall be maintained locked during the entire course of construction. No construction activities shall be permitted in these areas, including storage of construction materials.
7. Primary Path of Travel: Those areas which will experience a high degree of traffic, primarily at the lobbies and main corridors.
 8. Secondary Path of Travel: All other areas outside the required path for heavy construction, where access is required to perform secondary construction procedures. The Secondary Path of Travel shall be locked, and access shall be controlled and limited by the Contractor.
- C. Dust Protection where demolition work is required.
1. Seal all floor, wall and ceiling openings to prevent the intrusion of dust into these spaces. Provide dust curtains at doors.
 2. Construct temporary partitions surrounding the area of construction in these areas.
 3. Dust-Proof Wrap: Cover surfaces with polyethylene plastic. Seal seams completely with duct tape. Anchor to protection wherever possible. Attach to historic materials with preservation tape. Do not use duct tape or mechanical fasteners on historic materials.
 4. Dust-Proof Temporary Partitions: Construct floor to ceiling wood frame with 2 x 4-inch, or 2 x 6-inch lumber at 16-inches on center. Staple double layers of polyethylene plastic to either side, seal seams with duct tape. Seal interface with unprotected materials with preservation tape.
- D. Ceilings: Provide dust-proof wrap on all acoustical tile ceilings and other acoustic and fabric ceiling surfaces.
- E. Miscellaneous moldings, trim and surrounds, including, but not limited to: Stone column covers, wood picture moldings, chair rails, bases, window and door surrounds, and other miscellaneous stone finishes and millwork:
1. Primary Path of Travel: Extend wall protection over these elements.
 2. Secondary Path of Travel: Verify extent of potential impact to these elements with Architect. If protection is required, carefully protect in place as specified for floors.
- F. Wood Doors and Frames:
1. Primary Path of Travel: Protection will consist of 1/2-inch soft fiberboard and plywood screwed to 2 by 4 inch shoring braces set at 16-inches to four feet apart. Existing door to be removed and stored during construction. Provide a temporary door and complete enclosure of existing door surrounds.
 2. Secondary Path of Travel: Verify extent of potential impact to these elements with Construction Manager. If protection is required carefully remove these elements for reinstallation and protect frame as specified.
- G. Miscellaneous Hardware: Verify extent of potential impact to these elements with Architect. Where protection is required, carefully remove and catalog these elements for reinstallation.

July 11, 2018

- H. Light Fixtures: Verify extent of potential impact to these elements with Architect. Remove, catalog and store impacted fixtures.
- I. Weather Protection: Protect existing building interior and all materials and equipment from weather at all times.
- J. Temporary coverings shall be attended as necessary to insure effectiveness and to prevent displacement.
- K. Contractor shall repair or replace all elements of the building damaged by failure to properly protect them from the weather to the satisfaction of the Architect at no additional cost to the Owner.

3.2 PREPARATION

- A. Cut, move or remove items as necessary for access to alterations and renovations work; replace and restore at completion.
- B. Remove unsuitable material not marked for salvage, such as rotted wood, rusted metals, and deteriorated masonry and concrete; replace materials as specified for finished work.
- C. Remove debris and abandoned items from area and from concealed spaces.
- D. Prepare surfaces and remove surface finishes to provide for proper installation of new work and new finishes.
- E. In areas where new base is scheduled to be installed on existing surfaces, the existing base shall be removed and the surface patched in preparation for the installation of new material.
- F. Coordinate with trades involved for the installation of new materials in establishing exact locations of materials to be removed.
- G. Clean, prepare and level all existing floors. All floor surfaces shall be left smooth, free from abrupt ridges, pits, cracks, depressions, dust, oil or other materials which will have adverse effect on, or will cause discoloration or damage to finished floor materials.
- H. Where alterations occur or new and old work join, the immediate, adjacent surfaces shall be cut, removed, patched, repaired or refinished and left in as good a condition as existing prior to the start of the work. The materials and workmanship employed in the alterations involved by the new construction, unless otherwise indicated or specified shall conform to that of the original work.
- I. Where new finishes are indicated on walls on which wall covering occurs, completely remove the wall covering, adhesive and trim, where applicable. Patch, clean and wash wall surfaces and leave in a smooth, clean condition, as required for the installation or application of new finishes.

3.3 PREPARATION – SUBFLOORS AND FINISH FLOORING SUBSTRATE

- A. General: Substrates: These requirements apply to existing subfloors and are in addition to preparation required for new subfloors and substrates.

- B. Comply with specified requirements for preparation of existing floors, patching and leveling of flooring substrates and subfloors damaged by demolition operations; refer to the following Sections.
 - 1. Section 09 05 60 – COMMON WORK RESULTS FOR FLOORING. Applicable to all flooring work.
 - 2. Chemicals required for cleaning of floors shall be free of fumes and odors which will affect building occupants. Obtain Owner's approval for use of all such chemicals prior to start of work.
- C. Patching and leveling of flooring substrates and subfloors damaged by demolition operations: Comply with requirements of

3.4 INSTALLATION

- A. Coordinate work of alterations and renovations to expedite completion of Work.
- B. Remove, cut, and patch work in a manner to minimize damage and to provide means of restoring products and finishes to original or specified condition.
- C. Refinish visible existing surfaces to remain in renovated rooms and spaces, to specified condition for each material, with a neat transition to adjacent new finishes.
- D. Install products as specified in individual Sections.

3.5 ENCLOSURE OF EXPOSED PIPES AND CONDUIT

- A. Exposed piping and conduit in existing spaces: Not all chases and enclosures required in renovated areas are shown on drawings.
 - 1. Provide chases with finishes matching surrounding materials to enclose and completely conceal all new piping, ducts, and conduits located in renovated finished spaces.
 - 2. Build chases out of new materials specified under individual product specification sections, matching surrounding abutting m
 - 3. Construct chases and enclosures as small as possible, unless otherwise approved by Architect.
 - 4. Align new chases and enclosures with existing major architectural lines and planes.

3.6 TRANSITIONS

- A. Where new work abuts or aligns with existing, make a smooth and even transition. Patched work shall match existing adjacent work in texture and appearance.
- B. When surfaces are cut so that a smooth transition with new work is not possible, terminate existing surface along a straight line at a natural line of division and notify Architect.

3.7 ADJUSTMENTS

- A. Where removal of partitions results in adjacent spaces becoming one, rework floors, walls, and ceilings to a smooth plane without breaks, steps or bulkheads.

July 11, 2018

- B. Trim existing doors as necessary to clear new floor finishes; refinish trimmed areas.
- C. In any existing area in which a wall is furred, floor raised or ceiling dropped, all mechanical and electrical devices at that area shall be moved, relocated or rerouted in such manner that all work within that area shall conform to the new lines of work established by such indicated furring of walls, raising of floors or dropping of ceilings. The attention of all trades is directed to existing conditions and the various drawings for locations of work.

3.8 REMOVAL OF TEMPORARY PROTECTION

- A. Remove temporary materials and construction at Substantial Completion. Comply with requirements of Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS.

3.9 FINISHES

- A. Finish surfaces as specified in individual product specification sections.
- B. Finish patches to produce uniform finish and texture over entire area. When finish cannot be matched, refinish entire surface to nearest intersections.
- C. Provide complete restoration of areas damaged due to work under the contract, to a condition equal to or similar to that existing before damage or injury. Restoration shall include repairing, rebuilding, or replacing damaged items at contractor's expense.

3.10 REPAIR OF EXISTING SURFACES

- A. Restore existing facilities used during construction to original conditions. Restore permanent facilities used during construction to specified condition.
- B. Repair substrates prior to patching finish.
- C. Repair and clean existing finishes and materials damaged in the performance of the Work of this Contract.
- D. Repair existing finishes and materials damaged by installation or use of temporary work.
- E. General: Comply with cleaning requirements specified in Section 01 73 00 - EXECUTION.

3.11 CLEANING OF EXISTING SURFACES

- A. General Cleaning: Immediately before Owner occupancy, thoroughly and completely scrub and clean all existing interior finishes, and surfaces indicated to remain in the finished work. Leave floors, walls, windows, ceilings and all other surfaces clean and undamaged
 1. Remove all dirt, soil, stains, graffiti, and marks.
 2. Remove paint and smears.
 3. Clean all glass surfaces (inside and outside).
 4. Replace scratched glass.

5. Clean and polish hardware and fixtures.
- B. Specific Cleaning: Where specific cleaning is indicated, thoroughly clean and scrub to "like new" condition using effective means, methods, and techniques which do not damage the substrates or other nearby finishes or substrates.
1. Mock-Ups: Provide minimum 100 square feet mock-ups and obtain Architect's approval of cleaning before continuing work. Repeat mock-up procedure until Architect's approval is obtained. Employ several different cleaning agents and determine through trial and error which cleaning materials and techniques work best to achieve required results.
 2. Criteria for Acceptance: To be considered "clean", the surfaces shall be free of all dirt, soil, stains, graffiti, marks, mold, mildew, old wax, and foreign substances, and the surfaces shall match approved mock-ups. Do not damage the surfaces to be cleaned nor other nearby surfaces. Do not scratch or etch glazed and polished surfaces.

End of Section

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Section 01 41 00
REGULATORY REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section consists of:
1. Applicable codes and regulations.
 2. Wage rate compliance.

1.2 DEFINITIONS

- A. Regulations include laws, ordinances, statutes and lawful orders issued by authorities having jurisdiction, and rules, conventions and agreements within the construction industry that control performance of the Work, whether lawfully imposed by authorities having jurisdiction or not.

1.3 APPLICABLE CODES AND REGULATIONS

- A. All work shall be performed in accordance with the latest version, by DATE OF ISSUE for Contract Documents, current on date of Owner-Contractor Agreement, except as indicated otherwise, of all applicable codes including the following:
1. 2015 International Building Code (IBC) with Massachusetts Building Code, Ninth Edition amendments (780 CMR).
 2. 2015 International Energy Conservation Code with Massachusetts Building Code amendments, (Effective August 12, 2016 under the 780 CMR, Eighth Edition).
 3. 2015 International Mechanical Code (IMC).
 4. Massachusetts Electrical Code (2017 National Electrical Code [NFPA 70, 2017 edition], with Massachusetts modifications from 527 CMR 12.00).
 5. Massachusetts Fuel, Gas, and Plumbing Code (2002 National Fuel Gas Code [ANSI Z223.1-NFPA 54], with Massachusetts modifications from 248 CMR 5.00).
 6. Massachusetts Comprehensive Fire Safety Code (527 CMR) [2012 NFPA 1 as amended], effective January 1, 2015, as amended through November 4, 2016 and MGL Chapter 148.
 7. Commonwealth of Massachusetts Regulation 521 CMR: *Architectural Access Board*.
 8. Town of Halifax Zoning Bylaws, 5/8/2017, as amended.
 9. United States Occupational Safety and Health Administration (OSHA): Standard N°. 29-CFR-1926.59 - HAZARD COMMUNICATION STANDARD.
- B. Publication Dates: Where the date of issue of a code or regulation is not specified, comply with the standard in effect as of date of Contract Documents, or as otherwise required by authorities having jurisdiction.

July 11, 2018

POPE'S TAVERN
ADDITION/RENOVATION
Halifax, Massachusetts

1.4 WAGE RATE COMPLIANCE

- A. The General Contractor is responsible to ensure that the rate per hour to be paid to mechanics, apprentices, teamsters, laborers and other workers employed on the Work shall not be less than the approved wage rates applicable to this project. A legible copy of the approved rates, along with equal opportunity requirements, shall be posted on a weatherproof bulletin board outside the field office and be clearly visible for review by all workers.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

End of Section

Section 01 41 17
UTILITIES NOTIFICATION

PART 1 – GENERAL

1.1 GENERAL PROVISIONS

- A. Comply with all regulations and laws concerning excavation, demolition, or explosive work and be advised of utility notification requirements under Chapter 82, Section 40 of the Massachusetts General Laws.

1.2 ADMINISTRATIVE AUTHORITY

- A. Notification of utilities within the Commonwealth is performed through the Utilities Underground Plant Damage Prevention System, commonly referred to as “Dig Safe”.

1.3 REGULATORY REQUIREMENTS

- A. Contractors must notify “Dig Safe” by telephone before performing any earth moving operations including: digging, trenching, boring, site demolition, excavation, backfilling, grading, or explosive work in all public ways and private property.
- B. This notification must be made at least 72 hours (excluding weekends and holidays) prior to the Work described above, but not more than 30 calendar days before commencement of the contemplated Work. Notification shall occur between 6:00 AM to 6:00 PM local time from Monday to Friday, except in cases of emergency.
 - 1. The toll free phone number is: **811**.
 - 2. Provide the following information:
 - a. Municipality.
 - b. Location of work.
 - c. Intersecting street.
 - d. Type of work.
 - e. Starting date and time of work.
 - f. Name and title of caller.
 - g. Phone number of caller.
 - h. Best time for “Dig Safe” to return calls.
 - i. Company name of General Contractor or Construction Manager.
 - j. Company name of sub-contractor performing subgrade work.
- C. Member utilities of the Utilities Underground Plant Damage Prevention System are required to respond to the notice within 72 hours from the time said notice is received by designating at the locus the location of pipes, mains, wires, or conduits.
 - 1. Locations of underground utilities will be marked by spray paint or stakes. Marks will be color coded with additional descriptions of letters and arrows as required.

July 11, 2018

- D. Do not commence work until "Dig Safe" has been properly notified and has responded as described above.
- E. Subsequently notify "Dig Safe" of unanticipated additional blasting required after the initial notification to "Dig Safe" has been made. Do not perform the additional blasting work in less than 4 hours following the subsequent notification.

1.4 PROTECTION

- A. The Contractor is fully responsible for protection of the utility location markings, wherever these occur, on or off-site.
- B. Perform Work in such a manner, and with reasonable precautions taken to avoid damage to utilities under the surface in said areas of work. Immediately notify any known or suspected damage to underground utilities to the owner of such utilities.

PART 2 - PRODUCTS (not used)

PART 3 - EXECUTION (not used)

End of Section

Section 01 42 00
REFERENCES

PART 1 - GENERAL

1.1 SUMMARY

- A. Abbreviations and Acronyms.
- B. Definitions
- C. Reference Standards.

1.2 ABBREVIATIONS AND ACRONYMS

- A. The following list of common abbreviations are referenced in individual specification sections. This list is provided for convenience to the Contractor and is not intended to define all abbreviations use in the Contract Documents.

- 1. Abbreviations for contract and specifications.

DCAMM	Massachusetts Division of Capital Asset Management and Maintenance
DCR	Massachusetts Department of Conservation and Recreation
EPA	United States Environmental Protection Agency
HHS	US Department of Health and Human Services
HVAC	Heating, ventilating, and air conditioning
IAQ	Indoor Air Quality
IEQ	Indoor Environmental Quality
MEPA	Massachusetts Environmental Protection Agency
MGL	Commonwealth of Massachusetts General Laws
MSDS	Material Safety Data Sheet
NIC	Not in Contract
OFCI	Owner Furnished, Contractor Installed
OFI or OFOI	Owner Furnished and Installed (Owner Furnished, Owner Installed)
VOC	Volatile Organic Compounds

- B. Abbreviations for measurements and quantities.

C	Celsius
cm	Centimeter
F	Fahrenheit
Hrs	Hours
Kg	Kilogram
L	Liter
M	meter
m ² or SM	square meter
m ³ or CM	cubic meter
mm	Millimeter

REFERENCES

Mths	Months
psi	Pounds per square inch
t	ton

1.3 DEFINITIONS

- A. Definitions of contracting parties (Owner, Owner's Project Manager, and Architect): Refer to Section 01 10 00 – PROJECT SUMMARY.
- B. Definitions for terms utilized in the Contract Documents:
1. "As necessary," "as directed," "when directed," "satisfactory," "good and sufficient," "approved," or other general qualifying terms are used on the Drawings: These terms are deemed to be followed by the words, "in the opinion of the Architect," or "by the Architect," as the case may be."
 2. "Addenda": written or graphic instruments issued prior to the execution of the Contract which modify or interpret the Bidding Documents, including the Drawings and Specifications, by additions, deletions, clarifications or corrections.
 3. "Approval," "approved," "approved equal," "or equal," or "other approved" means as approved by the Architect."
 4. The terms "Contractor", "General Contractor", and "Construction Manager" as used in the Project Manual have the same meaning and are interchangeable in Contract Documents. These terms refer to the same entity.
 5. The term "Day": is defined as the following:
 - a. The term "calendar day" is a full 24 hour period, starting from 12 AM (midnight), and includes all weekends and legal holidays.
 - b. The term "working day" shall mean any calendar day except Saturdays, Sundays, and legal holidays at the place of the building.
 - c. Where the term "day" is used without the adjective of "calendar" or "working", it shall mean "calendar day".
 6. The terms "Designer", "Architect", and "Architect/Engineer" as used in the Project Manual have the same meaning and are interchangeable in Contract Documents. These terms refer to the same entity.
 7. "Furnish and Install" or "Provide": items identified shall be furnished and installed under this Contract. The term "Furnish", when used separately, shall mean that the items referred to shall be furnished, only. Similarly the term "install", when used separately, shall mean that the items referred to shall be installed, only.
 8. "Knowledge," "recognize" and "discover," their respective derivatives and similar terms in the Contract Documents, as used in reference to the Contractor, shall be interpreted to mean that which the Contractor knows (or should know), recognizes (or should recognize) and discovers (or should discover) in exercising the care, skill and diligence required by the Contract Documents. Analogously, the expression "reasonably inferable" and similar terms in the Contract Documents shall be interpreted to mean reasonably inferable by a Contractor familiar with the Project and exercising the care, skill and diligence required of the contractor by the Contract Documents.
 9. "Not in Contract" or "N.I.C.": equipment, furnishings, or other materials not included as a part of this Contract.

REFERENCES

July 11, 2018

10. "Product": materials, systems and equipment.

1.4 REFERENCE STANDARDS

- A. For products or workmanship specified by association, trade, or Federal Standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.
- B. Conform to reference standard by DATE OF ISSUE for Contract Documents, current on date of Owner-Contractor Agreement.
- C. Should specified reference standards conflict with Contract Documents, request clarification from Architect before proceeding.
- D. The contractual relationship to the parties to the Contract shall not be altered from the Contract Documents by mention or inference otherwise in any reference document.

E. Schedule of References

- 1. Listed below are abbreviations for the names and titles of trade association names, federal government agencies and similar organizations which are referenced in the individual specification sections. The addresses and URL's (Uniform Resource Locators) provided are for the Contractor's convenience and are believed to be current and accurate, however addresses and URL's frequently change, and no assurance is made on their accuracy:

AA	Aluminum Association 900 19th Street N.W., Suite 300 Washington, DC 20006 www.aluminum.com
ABAA	Air Barrier Association of America 1600 Boston-Providence Highway Walpole, MA 02081 www.airbarrier.org
AAMA	American Architectural Manufacturer's Association 1827 Walden Office Sq., Suite 104 Schaumburg, IL 60173-4268 www.aamanet.org
AATCC	American Association of Textile Chemists and Colorists PO Box 12215, 1 Davis Drive, Research Triangle Park, NC 27709-2215 www.aatcc.org
ACI	American Concrete Institute, International 38800 Country Club Drive, Farmington Hills, Michigan 48331 www.aci-int.org
ACPA	American Concrete Pipe Association 222 West Las Colinas Boulevard, Suite 641, Irving TX www.concrete-pipe.org
ADC	Air Diffusion Council 104 S. Michigan Ave, Suite 1500, Chicago, IL 60603 www.flexibleduct.org
AFPA	American Forest & Paper Association (Formerly NFPA National Forest Products Association) 1111 19 th St. N.W., Suite 800, Washington, DC 20036 www.afandpa.org
AGA	American Gas Association Inc. 1515 Wilson Blvd. Arlington, VA 22209-2469 www.agagas.com

REFERENCES

AGAI	American Galvanizers Association Inc. 12200 E.Liff Ave, Suite 204, Aurora, CO 80014-1252 www.galvanizeit.org
AIA	American Institute of Architects 1735 New York Avenue, N.W., Washington, DC 20006-5292 www.aia.org
AIHA	American Industrial Hygiene Association 2700 Prosperity Ave, Suite 250, Fairfax VA 22031 www.aiha.org
AISC	American Institute of Steel Construction 1 E. Wacker Dr., Suite 3100, Chicago,IL 60601-2001 www.aisc.org
AMCA	Air Movement and Control Association 30 W. University Drive, Arlington Heights, IL 60004-1893 www.amca.org
ANSI	American National Standards Institute 11 W. 42 nd Street, 13 Floor, New York, NY 10036 www.ansi.org
APA	APA - The Engineered Wood Association (formerly APA - American Plywood Association) P.O. Box 11700, Tacoma, WA 98411-0070 www.apawood.org
ARI	Air-Conditioning and Refrigeration Institute 4301 N. Fairfax Dr., Suite 425, Arlington, VA 22203 www.ari.org
ASCA	Architectural Spray Coaters Association 230 West Wells Street, Suite 311, Milwaukee WI 53203 www.aecinfo.com
ASHRAE	American Society of Heating, Refrigerating, and Air-Conditioning Engineers 1791 Tullie Circle NE, Atlanta GA.30329 www.ashrae.org
ASME	American Society of Mechanical Engineers 345 East 47th Street, New York, NY 10017-2392 www.asme.org
ASTM	American Society for Testing and Materials 100 Barr Harbor Drive, West Conshohocken, PA 19428 www.astm.org
AWI	Architectural Woodwork Institute 46179 Westlake Drive, Suite 120, Potomac Falls, VA 20165 www.awinet.org
AWMAC	Architectural Woodwork Manufacturers Association of Canada Unit 02A 4803 Centre St. NW, Calgary, Alberta, Canada www.awmac.com
AWPA	American Wood Preservers' Association P.O. Box 286, Woodstock, MD 21163-0286 www.awpa.com
AWPI	American Wood Preservers' Institution 1945 Old Gallows Rd., Suite 150, Vienna, VA 22182 www.oas.org
AWS	American Welding Society 550 LeJeune Road, N.W., Miami, FL 33126 www.aws.org

REFERENCES

BHMA	Builders Hardware Manufacturers Association, Inc. 355 Lexington Ave., 17 Floor New York, NY 10017 www.buildershardware.com
BIA	Brick Industry Association 11490 Commerce Park Drive, Reston, VA 22091-1525 www.bia.org
CSA	Canadian Standards Assoc. International, Forest Products Group Sussex Centre, Suite 402, 90 Burnhamthorpe Road West, Mississauga, Ontario, Canada www.csa.ca
CDA	Copper Development Association 260 Madison Ave., 16 th Floor, New York, NY 10016 www.copper.org
CISCA	Ceilings & Interior Systems Construction Association 579 W. North Ave., Suite 301, Elmhurst, IL 60126 www.cisca.org
CRI	Carpet and Rug Institute 310 Holiday Ave, Dalton, GA 30720 www.carpet-rug.com
CRSI	Concrete Reinforcing Steel Institute 933 N. Plum Grove Road, Schaumburg, IL 60173-4758 www.crsi.org
CPSC	Consumer Product Safety Commission 5401 Westbard Ave., Bethesda, MD 20816-1469 www.cpsc.gov
CTIOA	Ceramic Tile Institute of America 12061 W. Jefferson BLVD, Culver City, CA 90230-6219 www.ctioa.org
DHI	Door and Hardware Institute 14170 Newbrook Dr., Chantilly, VA 22021-2223 www.dhi.org
FM	Factory Mutual Engineering & Research Corp. 1151 Boston-Providence Turnpike Norwood, MA 02062 www.fmglobal.com
GA	Gypsum Association 6525 Belcrest Road, Suite 480, Hyattsville, MD 20782 www.gypsum.org
GANA	Glass Association of North America 2945 S.W. Wanamaker Dr., Suite A, Topeka, KS 66612-5321 www.glass.org
GICC	Glazing Industry Code Committee 3310 Harrison St., Topeka, KS 66611-2279 www.glazingcodes.net
HPVA	Hardwood Plywood & Veneer Association 1825 Michael Faraday Drive Reston, Virginia 20190 www.hpva.org
IGCC	Insulating Glass Certification Council 3933 US Route 11, PO Box 2040, Cortland, NY 13045 www.igcc.org
ILI	Indiana Limestone Institute of America, Inc. Stone City Bank Building, Suite 400, Bedford, IN 47421 www.iliai.com

REFERENCES

LSGA	Laminators Safety Glass Association 3310 Harrison Street, Topeka KS 66611-2279 www.glass.org
MCAA	Mason Contractors Association of America 1910 S. Highland Ave. Suite 101, Lombard, IL 60148 www.masoncontractors.org
MIL	Military Specifications and Standards Naval Publications and Forms Center 5801 Tabor Avenue, Philadelphia, PA 19120 www.milspec.com
NAAMM	National Association of Architectural Metal Manufacturers 8 South Michigan Avenue, Suite 1000, Chicago, IL 60603 www.naamm.org
NCMA	National Concrete Masonry Association 2302 Horse Pen Road, Herndon, VA 20171-3499 www.ncma.org
NEBB	National Environmental Balancing Bureau 8575 Government Circle, Gaithersburg, MD 20877-4121 www.nebb.org
NEMA	National Electrical Manufacturers' Association 1300 N. 17 th St., Suite 1846, Rosslyn, VA 22209 www.nema.org
NFPA	National Fire Protection Association 1 Battery March Park, PO Box 9101, Quincy, MA 02269 www.nfpa.org
NFRC	National Fenestration Rating Council 6305 Ivy Lane, Greenbelt MD 20770 www.nfrc.org
NRCA	National Roofing Contractors Association 10255 W. Higgins Road, Suite 600, Rosemont, IL 60018-5607 www.nrca.net
NTMA	National Terrazzo and Mosaic Association 110 E. Market St., Suite 200A, Leesburg, VA 20176 www.ntma.com
PCA	Portland Cement Association 5420 Old Orchard Road, Skokie, IL 60077-1083 www.cement.org
PEI	Porcelain Enamel Institute 4004 Hillsboro Pike, Suite 224B, Nashville, TN 37215 www.porcelainenamel.com
PS	Product Standard U. S. Department of Commerce www.omg.org
SDI	Steel Deck Institute P.O. Box 25, Fox River Grove, IL 60021-0025 www.sdi.org
SDI	Steel Door Institute 30200 Detroit Road, Cleveland, OH 44145-1967 www.steeldoor.org
SGCC	Safety Glass Certification Council RMS, P.O. Box 9 Henderson Harbor, NY 13651 www.sgcc.org

REFERENCES

SIGMA	Sealed Insulating Glass Manufacturers Association 401 N. Michigan Ave., Suite 2400, Chicago, IL 60611 www.glasschange.com
SMACNA	Sheet Metal and Air Conditioning Contractors' National Association 4201 Lafayette Center Dr., Chantilly, VA 22022-1209 www.smacnapa.org
SPIB	Southern Pine Inspection Bureau 4709 Scenic Highway, Pensacola, FL 32504-9094 www.spib.org
SSMA	Steel Stud Manufacturer's Association 8 South Michigan Avenue, Chicago IL 60603 www.ssma.com
SSPC	The Society for Protective Coatings 40 24 th Street, 6 th Floor, Pittsburgh PA 15222-4623 www.sspc.org
SWRI	Sealant, Waterproofing & Restoration Institute 2841 Main Street, Suite 585, Kansas City, MO 64108 www.swrionline.org
TCNA	Tile Council of North America, Inc. 100 Clemson Research Blvd., Anderson, SC 29625 www.tileusa.com <i>(formerly TCA, Tile Council of America)</i>
UL	Underwriters' Laboratories, Inc. 333 Pfingston Road, Northbrook, IL 60602 www.ul.com
WDMA	Window & Door Manufacturers Association (formerly National Wood Window & Door Association, NWWDA) 205 E. Touhy Avenue, Suite G-54, Des Plaines, IL 60018 www.nwwda.org
WI	Woodwork Institute PO Box 980247 West Sacramento, CA 95798 www.woodworkinstitute.com

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

End of Section

REFERENCES

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Section 01 45 00
QUALITY CONTROL

PART 1 - GENERAL

1.1 SUMMARY

- A. General quality assurance and control of installation.
- B. Site safety, worker safety and training.
- C. Contractor's quality control (QC) program.
- D. Source quality control.
- E. Field samples and mock-ups.
- F. Manufacturer's field services and reports.
- G. Field quality control, Owner's right for confirmation.

1.2 RELATED REQUIREMENTS

- A. Section 01 45 29 - TESTING LABORATORY SERVICES.

1.3 GENERAL QUALITY ASSURANCE AND CONTROL OF INSTALLATION

- A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce Work of specified quality.
- B. Comply fully with manufacturers' instructions, including performance of each step in sequence. Notify Architect when manufacturers' instructions conflict with the provisions and requirements of the Contract Documents; obtain clarification before proceeding with the work affected by the conflict.
- C. Comply with specified standards as a minimum quality for the Work except when more stringent tolerances, codes, or specified requirements indicate high standards or more precise workmanship.
- D. Perform work by persons qualified to produce workmanship of specified quality.
- E. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion or disfigurement.

1.4 SITE SAFETY, WORKER SAFETY AND TRAINING

- A. General: The Contractor (and his Filed-Subcontractors) shall, at all times, exercise reasonable precautions for the safety of all persons. All rules, regulations, and laws concerning safety that are in effect at the work site, and in particular, all applicable regulations of the Occupational Safety and Health Administration (OSHA) of the U.S. Government, in addition to specified requirements shall be complied with in all respects.

1. Contractor's responsibility for safety shall apply continuously twenty four (24) hours per Day during the term of this Contract and is not limited to normal working hours.
- B. Contractor's safety program: Prior to commencement of the Work, the Contractor shall develop and implement a Safety and Health Plan to comply with the Occupational Safety and Health Administration (OSHA) standards for the Construction Industry and all other applicable Federal, State, local laws and regulations. Contractor's Safety and Health Plan, and included health and safety procedures and policies, shall be submitted to the Architect and Owner's Representative within fifteen (15) Days after the date of Notice to Proceed and in no event later than commencement of the Work, whichever occurs first.
 1. Perform pre planning to ensure access is provided to Fire Department for all areas of the work site throughout the duration of the Contract. The Contractor shall provide the Fire Department site access maps, updated regularly, to reflect changes in the layout of the work site and shall notify the Fire Department when each update is made
 2. Post and maintain, at prominent locations throughout the Project site, emergency telephone numbers and shall insure that all personnel on site are continuously aware of this information.
 3. Ensure safe access to the Work for the Owner, Architect, Architect's consultants, their designated representatives, and all others charged with inspection, testing and monitoring of the Work, and visitors to the site. The Contractor shall furnish site visitors with safety equipment, test equipment, safety apparel and instructions that are required to insure their safety on site, and in the performance of their duties related to the Work of this Contract
- C. All employees to be employed at the worksite will have successfully completed a course in construction safety and health approved by the United States Occupational Safety and Health Administration (OSHA) that is at least 10 hours in duration. The OSHA training and certification course shall occur at the time each employee begins work. Furnish documentation to Owner and Architect, for each employee documenting successful completion of the OSHA safety training and certification course. Submit with the first certified payroll report. Comply fully with all laws and regulations applicable to awards made subject to Massachusetts General Laws (MGL) Chapter 149, Section 44A.

1.5 CONTRACTOR'S QUALITY CONTROL PROGRAM

- A. Procedures: Contractor and each subcontractor shall include all labor, materials, equipment, services and incidental items necessary to implement quality control procedures to the extent necessary to demonstrate and maintain compliance with the Contract Documents.
- B. Quality Control Plan: Within 20 days after Notice to Proceed, the Contractor shall submit a Quality Control (QC) Plan to the Owner's Representative and Architect for approval. The plan shall address the following, as a minimum:
 1. The Contractor's commitment to quality and implementing and managing the QC program.
 2. Identification of the Contractor's onsite QC Manager, with name, qualifications, duties and responsibilities. The QC Manager shall have the authority to direct the removal and replacement of non-conforming work. The

QC Manager shall be present for all QC meetings, inspections and tests during the project.

3. Procedures for addressing and commenting QC with Contractor's staff, all subcontractors and suppliers, and Owner, Architect and Owner's representative.
 4. Procedures for review of submittals and submittal status, and documentation of same.
 5. Procedures for pre-installation meetings and documentation of same.
 6. Procedures for inspections of deliveries and documentation of same.
 7. Procedures for benchmark inspections, defined as initial installations, and documentation of same.
 8. Procedures for mockup inspections and documentation of same.
 9. Procedures for equipment in place, inspections and documentation of same.
 10. Procedures for inspections prior to closures of concealment and documentation of same.
 11. Procedures for start-up and commissioning and documentation of same.
 12. Procedures for turnover and documentation of same.
 13. Procedures for identifying, recording, tracking correcting and reporting items requiring rework, using a Rolling Completion list chronological item number, phase area, date listed, description, party responsible for correction, date notified, and date corrected.
 14. Procedures for testing and documentation of same.
 15. Procedures for corrective action on Architect's Field Reports and Testing Agency reports and documentation of same.
- C. Procedures for reporting on all of the above on a monthly basis as a condition precedent to review of the Contractor's application for payment.

1.6 SOURCE QUALITY CONTROL

- A. 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.
- B. 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.
- C. Product Labeling: Attach label from agency approved by authority having jurisdiction for products, assemblies, and systems required to be labeled by applicable code(s).
 1. Label Information: Include manufacturer's or fabricator's identification, approved agency identification, and the following information, as applicable, on each label.
 - a. Model number.
 - b. Serial number.
 - c. Performance characteristics.

1.7 FIELD SAMPLES

- A. Install field samples demonstrating quality level for the Work, at the site as required by individual specifications Sections for review and acceptance by Architect. Remove field samples prior to date of Final Inspection, or as directed.

1.8 MANUFACTURER'S FIELD SERVICES AND REPORTS

- A. When called for by individual Specification Sections, provide at no additional cost to the Owner, manufacturers' or product suppliers' qualified staff personnel, to observe site conditions, start-up of equipment, adjusting and balancing of equipment, conditions of surfaces and installation, quality of workmanship, and as specified under the various Sections.
 - 1. Individuals shall report all observations, site decisions, and instructions given to applicators or installers. Immediately notify Architect of any circumstances which are supplemental, or contrary to, manufacturer's written instructions.
 - 2. Submit full report within 30 calendar days from observed site conditions to Architect for review.

1.9 FIELD QUALITY CONTROL

- A. The Owner reserves the right to take samples and perform, at random, tests of approved materials delivered to the job site to verify compliance of actual materials with specifications.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

End of Section

Section 01 45 29
TESTING LABORATORY SERVICES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section consists of the following:
1. Quality assurance.
 2. Laboratory responsibilities.
 3. Laboratory reports.
 4. Limits on testing laboratory authority.
 5. Contractor responsibilities.
 6. Contractor submittals.
 7. Schedule of inspections and tests.
 8. Concrete in situ relative humidity, calcium chloride and acidity/alkalinity testing.

1.2 REFERENCES

- A. Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
1. ANSI/ASTM D 3740 - Standard Practice for Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock
 2. ANSI/ASTM E 329 - Standard Specification for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction.
 3. ASTM F 1869 – Standard Test Method for Measuring Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.
 4. ASTM F 2170 – Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using In-Situ Probes
 5. ASTM F 710 – Standard Practice for Preparing Concrete Floors and Other Monolithic Floors to Receive Resilient Flooring.

1.3 QUALITY ASSURANCE

- A. Comply with requirements of ANSI/ASTM D 3740 and ANSI/ASTM E 329.
- B. Laboratory: Authorized to operate in state in which Project is located.
- C. Laboratory staff: Maintain a full time specialist on staff to review services. Provide registered Engineer on staff for all review of services related to structural testing.
- D. Testing Equipment: Calibrated at reasonable intervals with devices of an accuracy traceable to either the National Bureau of Standards (NBS) Standards or accepted values of natural physical constraints.

1.4 LABORATORY RESPONSIBILITIES

- A. Cooperate with Architect and Contractor in performance of services; provide qualified personnel promptly on notice.
 - 1. Attend preconstruction conferences and progress meetings, as requested.
- B. Acquaint Owner, Architect, and Contractor's superintendent with testing procedures and with all special conditions encountered at the site.
- C. Perform specified Inspection, sampling, and testing of products and construction methods in accordance with specified standards as specified in individual technical specification sections:
 - 1. Comply with specified standards, ASTM, ANSI, and other recognized authorities.
 - 2. Conduct and interpret the tests and state in each report whether the test specimens comply with the requirements, and specifically state any deviations therefrom.
 - 3. Obtain Contractor's written acknowledgment of each inspection, sampling, and test made. Test samples of mixes submitted by Contractor.
 - 4. Ascertain compliance of materials and mixes with requirements of Contract Documents.
- D. Promptly notify Architect and Contractor of irregularities, deficiencies, or non-conformance of Work or Products which are observed during performance of services.
- E. Promptly submit written report of each test and inspection; one copy each to Architect, Owner, Contractor, and one copy to Project Record Documents File.
- F. Perform additional inspections and tests required by Architect/Engineer.

1.5 LABORATORY REPORTS

- A. After each test, promptly distribute directly from the testing laboratory, copies of laboratory report to:
 - 1. Owner's Project Representative.
 - 2. Architect's office.
 - 3. Consulting engineer's office.
 - 4. Contractor's office.
 - 5. Municipal Inspectional Services Department, if required.
- B. Include in report the following information:
 - 1. Date issued.
 - 2. Project title and number.
 - 3. Testing laboratory name, address, and telephone number.
 - 4. Name and signature of laboratory inspector.
 - 5. Date and time of sampling.
 - 6. Record of temperature and weather conditions (as appropriate to test).

7. Identification of product and Specifications Section.
8. Location of sample or test in the Project.
9. Type of inspection or test.
10. Results of tests and compliance with Contract Documents.
11. Interpretation of test results, when requested by Architect.
12. Observations regarding compliance with Contract Documents.

1.6 LIMITS ON TESTING LABORATORY AUTHORITY

- A. Laboratory may not release, revoke, alter, or enlarge on requirements of Contract Documents.
- B. Laboratory may not approve or accept any portion of Work.
- C. Laboratory may not assume any duties for Contractor
- D. Laboratory has no authority to stop the Work.

1.7 CONTRACTOR RESPONSIBILITIES

- A. Coordinate and cooperate with laboratory personnel, provide access to Work.
 1. Monitor each inspection, sampling, and test.
 2. Provide Laboratory or Agency with written acknowledgment of each Inspection, sampling, and test.
 3. Within 24 hours notify Architect and Owner in writing of reasons for not acknowledging Laboratory results.
- B. Secure and deliver to the Laboratory or designated location, adequate quantities of representational samples of materials proposed to be used and which require testing, along with proposed mix designs.
- C. Furnish incidental labor and facilities:
 1. To provide access to Work to be tested.
 2. To obtain and handle samples at the Project site or at the source of the Product to be tested.
 3. To facilitate inspections and tests.
 4. For storage and curing of test samples.
- D. Furnish verification of materials and equipment compliance with Contract Documents.
- E. Notify Architect/Engineer and laboratory 24 hours prior to expected time for operations requiring inspection and testing services.
- F. Identify materials to be tested or inspected by Testing Laboratory or Agency.
- G. After determination of need for testing or inspecting by Owner, notify Laboratory sufficiently in advance, minimum five days, of operations to allow for its assignment of personnel and scheduling of tests.

1. When tests or inspections cannot be performed after such notice, reimburse Owner for laboratory personnel and travel expenses incurred due to Contractors negligence.
 - H. Make arrangements with laboratory and pay for additional samples and tests required for the following conditions:
 1. Initial testing indicates Work does not comply with Contract Documents.
 2. Contractor requested testing for additional testing and laboratory services beyond specified requirements.
- 1.8 CONDUCT OF INSPECTIONS AND TESTS
- A. The General Contractor shall notify the Owner, Architect, and Testing Laboratory a minimum of 72 hours before the performance of work to permit the proper conduct of Owner-authorized inspections and tests.
 - B. Representatives of Testing Laboratory will inspect the manufacture, assembly, and placement of materials as required and as authorized by the Owner, and report their findings to the Architect, Owner, and Contractor.
 - C. Work shall be checked as it progresses, but failure to detect any defective work or materials shall in no way prevent later rejection when such defect is discovered nor shall it obligate the Owner to accept such work.
- 1.9 SCHEDULE OF TESTING AND LABORATORIES BY OWNER
- A. Except as otherwise specified, Owner will appoint, employ, and pay services of independent firm(s) to perform inspection and testing and other services specified herein, in individual specification Sections, and as additionally required by the Architect.
 - B. Except as otherwise specified, Owner will employ services of an independent laboratory to perform specified inspection and testing;
 - C. Requirements for testing, observations, and inspections are described in individual specification sections; the schedule provided below is not intended to completely describe all of the inspection and testing Work required for this Contract, and is only furnished as a guide.
 1. Section 03 30 00 - Cast-in-Place Concrete: Concrete test cylinders
 2. Section 03 45 00 - Plant-Precast Architectural Concrete
 3. Section 05 12 00 - Structural Steel Framing: Testing of welds of field and shop fabricated components. Testing of bolting.
 - a. Bolt torque testing.
 - b. Welding X-ray and ultrasonic tests as specified.
 - c. Coating thickness of primer coats.
 4. Section 05 31 00 - Steel Decking: Periodic inspection of steel decking installation prior to concrete placement.
 5. Section 07 84 00 - Fireproofing: Testing and certification of density and thickness of installation.

6. Section 07 92 00 - Joint Sealants: Chemical analysis; adhesive strength; compatibility with adjacent materials; elasticity.
 7. Division 31, 32, 33 - Earthwork, Exterior Improvements, Utilities sections: Continuous observations basis during the installation of the foundation, footings, structural slab, and during backfilling and grading of the site. Testing bearing surfaces prior to the installation of the backfill and foundations. Sampling and compaction testing of fill materials.
 - a. Chemical testing of fill materials.
 - b. Proctor tests for compaction.
- D. Concrete slabs and floors: Relative Humidity, Moisture Vapor Emission and acidity/alkalinity (pH) Testing:
1. In addition to Contractor's own testing of concrete slabs and floors, Owner may employ and pay for services of an independent testing laboratory to confirm Contractor's testing results for relative humidity, moisture vapor emission, and pH tests of concrete slabs. This testing shall be witnessed by the Contractor, flooring subcontractors and Owner's Project Representative. Owner's testing includes:
 - a. Relative Humidity, Moisture Vapor Emission and pH Testing on all concrete slabs over-which a finished floor is to be installed. This includes, but is not limited to:
 - 1) Resilient sheet flooring, including (but not limited to) linoleum, rubber and vinyl flooring.
 - 2) Resilient tile and plank flooring, including (but not limited to) linoleum, rubber, solid vinyl and composite flooring.
 - 3) Static dissipative flooring.
 - 4) Resinous flooring and seamless flooring of all types.
 - 5) Painted floors and concrete sealers.
 - 6) Carpet.
 - 7) Wood flooring of all types.
 - 8) Terrazzo (excluding sand-bed terrazzo systems).
 - b. Perform moisture and pH tests on all concrete floors over-which stone flooring is to be applied.
 2. Requirements: As specified under Part 3 of this Section.
 - a. Submit 1 copy of test data to the installers of all flooring materials or coating materials scheduled to be installed.
 - b. Provide additional testing in the event test results indicate higher moisture content than recommended by the flooring material and coating material manufacturers for the installation of their products. Contractor shall perform such additional testing, at no additional cost to the Owner, after procedures have been performed to reduce moisture content to ratings acceptable to the various flooring and coating manufacturers.
- E. Special Tests and Inspections: Owner will engage a testing agency to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner.
1. Testing agency will notify Architect, and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.

July 11, 2018

2. Testing agency will submit a certified written report of each test, inspection, and similar quality-control service to Architect, with copy to Contractor and to authorities having jurisdiction.
3. Testing agency will submit a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
4. Testing agency will interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.
5. Testing agency will retest and re-inspect corrected work.

1.10 SCHEDULE OF TESTING AND LABORATORIES BY CONTRACTOR

- A. General Contractor shall employ and pay for services of an approved independent testing laboratory to perform inspection and testing specified under this Article and as additionally in individual specification sections
 1. Submit to Architect/Engineer a minimum of three independent testing laboratories for each type of testing specified by individual specification sections and those required by the referenced applicable codes, regulations and standards.
 2. Employment of testing laboratory shall in no way relieve Contractor of obligation to perform work in accordance with requirements of Contract Documents.
- B. Earthwork: Lab tests to determine suitability of all fill materials shall be paid for by Contractor.
 1. Owner reserves the right to retain and pay for his own testing for checking purposes
- C. Concrete Paving and General Concrete Work: Concrete mix design testing shall be paid for by Contractor. Owner reserves the right to retain and pay for his own testing for checking purposes.
- D. Flooring substrate testing, including in-situ concrete relative humidity, calcium chloride and acidity/alkalinity testing as specified under Section 09 05 60 - COMMON WORK RESULTS FOR FLOORING.
- E. Moisture content testing of interior and exterior wood prior to application of field painted coatings.
- F. Local Authority Inspections: The Contractor is also responsible for coordinating and cooperating with local requirements for inspections by local Authorities.

1.11 SCHEDULE OF TESTING AND LABORATORIES BY SUBCONTRACTORS

- A. Respective Filed-subcontractors shall employ and pay for services of an approved independent testing laboratory to perform inspection and testing specified under this Article and as additionally in individual specification sections
 1. Submit to Architect/Engineer a minimum of three independent testing laboratories for each type of testing specified by individual specification sections and those required by the referenced applicable codes, regulations and standards.

2. Employment of testing laboratory shall in no way relieve Contractor of obligation to perform work in accordance with requirements of Contract Documents.
- B. Fire Protection System: At least the following tests shall be performed. Conform to requirements specified in individual Division 21 Specification Sections. The test shall be performed and paid for by the subcontractor and witnessed by the Contractor, Resident Project Representative and authorities having jurisdiction:
1. Fire protection system flushed and pressure tested.
- C. Plumbing: At least the following tests shall be performed. Conform to requirements specified in individual Division 22 Specification Sections. The test shall be performed and paid for by the subcontractor and witnessed by the Contractor, Resident Project Representative and authorities having jurisdiction:
1. Water supply piping hydrostatic pressure test.
 2. Sanitary piping test before fixture installation: Cap pipes and fill to highest point in system.
 3. Plumbing fixture operation.
- D. HVAC Testing: All HVAC work shall be tested by an independent testing and balancing agency, approved by Owner. Conform to requirements specified in individual Division 23 Specification Sections. The tests shall be performed and paid for by the subcontractor and witnessed by the Contractor, Resident Project Representative and authorities having jurisdiction. Adjustments shall be made by the subcontractors directed by the Owner. At least the following tests shall be performed:
1. Piping hydrostatic tests.
 2. Air and water balancing.
 3. Thermostat control monitoring and testing.
 4. Boiler efficiency testing.
 5. Energy Management System operation.
- E. Electrical Power System Testing: At least the following tests shall be performed. Conform to requirements specified in individual Division 26 Specification Sections. The tests shall be performed and paid for by the subcontractor and witnessed by the Contractor, Resident Project Representative and authorities having jurisdiction:
1. Polarity tests.
 2. Operation of all circuits.
 3. Testing of emergency system.
 4. Security systems.
 5. Generation system.
 6. Grounding systems.
 7. Voice/Video/Data networking testing.
- F. Electrical Lighting System Testing: Conform to requirements specified in individual Division 26 Specification Sections. At least the following tests shall be performed and paid for by the Filed-subcontractor:
1. Operation of every component of entire system.

July 11, 2018

- G. Fire Alarm System Testing: At least the following tests will be performed. Conform to requirements specified in individual Division 26 Specification Sections. The test shall be performed and paid for by the subcontractor and witnessed by the Contractor, and Resident Project Representative:
 - 1. All smoke and heat detectors.
 - 2. Proper operation as required by authorities having jurisdiction.
- H. Where no testing requirements are described but the Owner or Architect/Engineer decides that testing is required, testing will be performed under current pertinent standards for testing.

1.12 FOLLOW-UP AND CORRECTIVE ACTION

- A. The Contractor and the Owner will note the test record on the Testing Log to acknowledge test procedures and results. If follow-up or corrective action is needed, the Contractor shall submit to the Owner two written copies of proposed follow-up or corrective plans and obtain the Owner's written approval before proceeding.
 - 1. Cost of Testing: If tests indicate that materials or work do not comply with requirements, the Contractor shall pay for all retesting, and shall remove and replace non-complying work at no additional cost to the Owner.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 CONCRETE IN SITU RELATIVE HUMIDITY, CALCIUM CHLORIDE AND ACIDITY/ALKALINITY TESTING

- A. Scope:
 - 1. Provide in situ concrete relative humidity and surface pH testing to all concrete slabs specified to be covered with floor coverings or resinous coatings. Includes concrete placed as part of this Work which occurs below grade, above grade (suspended slabs), and slabs on grade.
 - a. Existing building suspended slabs may be excluded from this requirement.
- B. Scheduling:
 - 1. Testing shall take place after allowing concrete to dry for a minimum of 90 days. Testing to be scheduled no less than one, nor more than three weeks prior to scheduled flooring installation.
 - a. DO NOT conduct testing unless the slab environment is identical to that in which the finished flooring is to be installed.
 - 2. In the event new flooring is to be installed over existing resilient flooring, remove the portion of the existing flooring and adhesive directly under the area where testing will be conducted. Patch flooring to match existing construction after completion of testing.
- C. Test result submittals:
 - 1. Report all test results in chart form listing test dates, time, depth of test well, in situ temperature, relative humidity, moisture vapor and pH levels.

2. List test locations on chart and show same on marked up Floor Plan Drawings.
 3. Submit results In duplicate. Deliver copies directly to Architect, Owner's Project Representative and General Contractor.
- D. Testing equipment: shall be equal to the following
1. For relative humidity testing:
 - a. Digital Meter and Calibrated Humidity and Temperature probe kit as manufactured by Vaisala Inc. (Boston Office) 10-D Gill Street, Woburn, MA, 01801, www.vaisala.com.
 - 1) Minimum 2 point probe calibration.
 2. For calcium chloride testing:
 - a. Anhydrous calcium chloride testing in accordance with Rubber Manufacturer's Association (RMA) Test requirements.
 - b. Test kits: Vaprecision, Inc. 17443 Mount Cliffwood Circle, Fountain Valley, CA 91708, www.vaprecision.com.
 3. For pH testing:
 - a. pH test paper by Micro Essential Laboratory, Inc., 4224 Avenue "H", Brooklyn, NY 11210, www.microessentiallab.com.
 - b. Distilled or de ionized water.
- E. Testing Procedures - Quantification of Relative Humidity
1. The test site should be maintained at the same temperature and humidity conditions as those anticipated during normal occupancy. These temperature and humidity levels should be maintained for 48 hours prior and during test period. If meeting this criteria is not possible, then minimum conditions should be 75 degrees F (plus or minus 10 degrees F), and 50 percent (plus or minus 10 percent) relative humidity. When a building is not under HVAC control, a recording hygrometer or data logger shall be in place recording conditions during the test period. A transcript of this information must be Included with the test report.
 2. The number of In situ relative humidity test sites is determined by the square footage of the facility. The minimum number of tests to be placed is equal to 3 in the first 1,000 square feet and 1 per each additional 1,000 square feet.
 3. Drill test holes utilizing a roto hammer drill. Hole diameter shall not exceed outside diameter of the insertable test sleeve by more than 0.04 inch. Drilling operation must be dry. Determine the thickness of the concrete slab from Construction Documents. Depths of test holes shall be as follows:
 - a. For elevated slabs (not poured in pans): Drill test holes to a depth equal to 20 percent of the concrete thickness.
 - b. For slabs on grade and elevated slabs in pans: Drill test holes to a depth equal to 40 percent of the concrete thickness.
 4. Vacuum all concrete dust from test hole.
 5. Insert a hole liner, or sleeve, to the full depth of test hole, assuring that the liner is capped or plugged at the end protruding from the concrete surface.
 6. Permit the test site to acclimate, or equilibrate, for 72 hours prior to taking relative humidity readings.

7. Remove the sleeve plug and place a probe into the sleeve assuring that it reaches the bottom of the test hole.
 8. Allow the probe to sit in the test sleeve for 30 minutes before taking readings.
 9. Read and record temperature and relative humidity at the test site.
- F. Testing Procedures - Quantification of Concrete Moisture Vapor Emission through Calcium Chloride Testing.
1. The test site should be maintained at the same temperature and humidity conditions as those anticipated during normal occupancy. These temperature and humidity levels should be maintained for 48 hours prior and during test period. If meeting this criteria is not possible, then minimum conditions should be 75 degrees F (plus or minus 10 degrees F) and 50 percent relative humidity (plus or minus 10 percent). When a building is not under HVAC control, a recording hygrometer or data logger shall be in place recording conditions during the test period. A transcript of this information must be included with the test report.
 2. The number of vapor emission test sites is determined by the square footage of the facility. The minimum number of tests to be placed is equal to 3 in the first 1,000 square feet and 1 per each additional 1,000 square feet.
 3. Test sites are to be cleaned of all adhesive residue, curing compounds, paints, sealers, floor coverings, and similar materials. 24 hours prior to the placement of test kits.
 4. Weigh test dish on site prior to start of test. Scale must report weight to 0.1 grams. Record weight and start time.
 5. Expose Calcium Chloride and set dish on concrete surface.
 6. Install test containment dome and allow test to proceed for 60 to 72 hours.
 7. Retrieve test dish by carefully cutting through containment dome. Close and reseal test dish.
 8. Weigh test dish on site recording weight and stop time.
 9. Calculate and report results as pounds of emission per 1,000 square feet per 24 hours."
- G. Testing Procedures - Quantification of Acidity/Alkalinity (pH) Level
1. At or near the relative humidity test site and each vapor emission (calcium chloride) test site, perform pH test.
 - a. At each testing site, lay down a loose 2 foot by 2 foot sheet of rubber flooring or non perforated polyethelene sheet backed by plywood. Leave in place for 48 hours.
 - b. Remove rubber sheet/polyethelene and place several drops of distilled or de ionized water onto the concrete surface to form a puddle approximately 1 inches in diameter.
 - c. Allow the water to set for approximately 60 seconds.
 - d. Dip the pH paper into the water and remove immediately, compare color to chart provided by paper supplier to determine pH reading
 2. Record and report results.
- H. Testing Procedures:

1. Initial testing: Provide 3 tests for the first 1,000 square feet.
2. Add one test for each additional 1,000 square feet.
3. Concrete surface area to be tested shall be completely clean. Remove all adhesives, residue, debris and sealing compounds. Remove all dust by vacuum or other methods. Do not use chemicals of any kind to clean concrete.
4. Perform moisture tests in strict accordance with the kit manufacturer's Instructions. Moisture tests shall remain undisturbed for 60 to 72 hours.
5. Immediately after moisture test has been removed from test area, conduct pH test in area previously covered by plastic dome of moisture test kit.
6. After completion of tests submit 2 copies of test data to the Architect. Submit a copy of the test data to all installers of flooring materials and resinous flooring materials scheduled to be installed.
7. Provide additional testing in the event test results indicate higher moisture content than recommended by the flooring material and coating material manufacturers for the installation of their products. Perform such additional testing, at no additional cost to the Owner, after procedures have been performed to reduce moisture content to ratings acceptable to the various flooring and coating manufacturers.

End of Section

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Section 01 50 00
TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

- A. Requirements for temporary facilities and controls .

1.2 GENERAL REQUIREMENTS

- A. The General Contractor shall provide and maintain all temporary facilities, controls, and construction aids as specified herein until they are replaced by permanent work, or until Project Substantial Completion, as appropriate.
1. Additional temporary facilities and controls which may be specified under individual Filed Sub-bid sections are the responsibility of the respective Filed Subcontractors.
 2. Temporary facilities removed from the Project shall remain the property of the Contractor, except as otherwise specified.
- B. Except where specifically noted otherwise, cost or use charges for temporary facilities, utility services, controls, and construction aids and similar items specified in this Section or as required to perform the Work, are not chargeable to the Awarding Authority or Architect, and will not be accepted as a basis of claims for a Change Order.
- C. Establish and initiate use of each temporary facility at time first reasonably required for proper performance of the Work. Terminate use and remove facilities at earliest reasonable time when they are no longer needed, or when permanent facilities have, with authorized use, replaced the temporary facilities.
1. Locate temporary facilities where they will serve Project adequately and result in minimum interference with performance of the Work.

1.3 SUBMITTALS

- A. Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
1. Reports of tests, inspections, meter readings and similar procedures performed on temporary utilities.
 2. Schedule showing implementation and termination of each temporary utility within 15 days of commencement of the Work.
 3. Shop drawings:
 - a. Temporary signage.
 - b. Site Plan: Show temporary facilities, utility hookups, staging areas, and parking areas for construction personnel.

1.4 REFERENCES

- A. Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES.

Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.

1. ANSI A 10 - Safety Requirements for Construction and Demolition.
2. NFPA 70 - National Electrical Code.
3. NFPA 241 - Building Construction and Demolition Operations.

1.5 TEMPORARY WEATHER PROTECTION

- A. Weather Protection Standards: The following weather protection standards pursuant to Sections 44F and G of Chapter 149 of the General Laws, are hereby incorporated into this specification, and shall be considered supplementary to the temporary heating and temporary enclosure requirements specified elsewhere in this Section and in individual specification Sections.
1. Limitation of Weather Protection Standards: Under the provisions of Chapter 149, Section 44F(1) and Section 44G, Para. D, of the Massachusetts General Laws (MGL), General Contractors are required to provide weather protection to allow building construction to be carried on between the dates of November 1 to March 31 (inclusive).
 - a. These standards do not require enclosures for heat for operations that are not economically feasible to protect in the judgment of the Awarding Authority; including for example, site work, excavation, pile driving, steel erection, erection of certain exterior panels, roofing and the similar construction elements.
 2. Definition of Weather Protection: "Weather Protection" means temporary protection of work which may be adversely affected by moisture, cold, heat, and wind by the use of temporary covers, enclosures, and heat. Maintain at least the minimum temperatures specific. Comply with specific requirements which are specified within individual Specification Sections.
 - a. Temperature at the working surface shall be at least forty degrees Fahrenheit (40 degrees F). This provision does not supersede any specific greater requirements for methods of construction of curing of materials.
 3. General Contractors Responsibilities:
 - a. The General Contractor shall furnish and install all "weather protection" Both (exterior and interior) during the time period from November 1 to March 31 (inclusive). The General Contractor is responsible to ensure that protection is provided for the building INTERIOR and all materials and equipment from weather at all times (year round).
 - b. At completion of work, the General Contractor shall remove temporary weather protection and restore all surfaces to first class condition.
 4. Filed Subcontractors Responsibilities: Individual Filed Subcontractors are responsible for all tarpaulins and similar protective measures necessary to cover scaffolding for inclement weather conditions during NON-WINTER months. NON-WINTER period is from April 1 to October 31 (inclusive).
 5. Proposed Plan: The General Contractor shall within 30 calendar days after Award of Contract, submit three copies of a typewritten proposed plan for "Weather Protection" and obtain the Architect's and Owner's written approval.
 6. Reporting Requirements:

- a. Within thirty calendar days after Contract award, the General Contractor shall submit in writing to the Owner for approval, three copies of its proposed plan for weather protection.
 - b. The General Contractor shall furnish and install accurate Fahrenheit thermometers at places designated by the Owner to determine whether the required temperature is being maintained.
 7. Weather protection materials, equipment, and the installation thereof, shall comply with all the safety rules and regulations including provisions for adequate ventilation and fire protection devices.
 8. Use of Permanent Heating System(s): The General Contractor may choose, if the Owner approves, to use the permanent heating system for temporary heat after the building is enclosed and the system has been tested and is ready to operate.
 - a. The General Contractor shall thoroughly clean and restore to first class condition, acceptable to the Owner, all portions of the permanent heating system that are used for heating during construction.
 - b. Use of the permanent heating system for weather protection shall not affect any heating system guarantee that may be due to the Owner; such guarantee shall begin to run only when the Owner accepts the building.
 - B. Additional weather protection requirements: The General Contractor is responsible to ensure that the protection is provided by for the building interior and all materials and equipment from weather at all times (year round).
 1. Where removal of existing roofing, roof sheathing, windows, doors, and other items is necessary to accomplish work, have materials and workmen ready to provide adequate and approve temporary covering of exposed areas.
 2. Temporary coverings shall be attended as necessary to insure effectiveness and to prevent displacement.
 3. Contractor shall repair or replace all elements of the building damaged by failure to properly protect them from the weather to the satisfaction of the Architect at no additional cost to the Owner.
- 1.6 TEMPORARY UTILITIES, GENERAL REQUIREMENTS
- A. General Installation: Install temporary utility service(s), or connect to existing service(s) as indicated, and as specified. Comply with all applicable laws, regulations, and requirements of authorities having jurisdiction.
 - B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.
- 1.7 TEMPORARY UTILITIES, ELECTRICITY
- A. Temporary electricity: The Owner will pay for electrical energy required for temporary light and power. The Contractor is required to hire an electrician licensed where project is located to provide temporary feeders of sufficient capacity from the facility's power lines, at the point coordinated with the Owner, to furnish electric light and power requirements for the work, while under construction.

July 11, 2018

1. Metering: The Owner reserves the right to require separate metering and for the Contractor to pay for electricity used, if, in the Owner's opinion, electricity is being wasted.
2. Electric power service: Use of existing electric power service will be permitted, as long as equipment is sufficient for Contractor's needs and is maintained in a condition acceptable to Owner. Provide additional weatherproof, grounded electric power service and distribution system of sufficient size, capacity, and power characteristics as required to furnish temporary electricity for construction operations. Include meters, transformers, overload protected disconnects, automatic ground-fault interrupters and main distribution switch gear.
 - a. Connect temporary service to Owner's existing power source, as directed by Owner.
 - b. Heavy electrical loads such as welding and other equipment with similar special power requirements must be powered by individual installers using portable electric generators at each user's own cost.
 - 1) Except as otherwise specifically provided, all additional costs resulting from such use shall be borne by the Contractor.
3. Distribution: A grounded receptacle (outlet) for an extension cord shall be provided by the Electrical Filed-Subcontractor within one hundred (100) feet of any part of the building. Individual users are responsible for their own work lamps and extension cords.

1.8 TEMPORARY UTILITIES, LIGHTING

- A. Temporary lighting: The Electrical Subcontractor shall provide lighting with local switching to fulfill security requirements and provide illumination for construction operations and traffic conditions. Maintain lighting, replace broken lamps and provide routine repairs.
 1. Temporary lighting shall be based on the following requirements:
 - a. Rooms or spaces under 250 square feet: Two 100 watt lamps.
 - b. Rooms or spaces over 250 square feet and under 500 square feet: Four 100 watt lamps.
 - c. Rooms or spaces 500 square feet and over: Two 200 watt lamps for spaces 500 to 1000 square feet, and two 200-watt lamps for every additional 1000 square feet or fraction thereof.
 - d. Provide sufficient additional fixtures and lamps to insure proper lighting in stairwells, corridors and passage areas.
 2. Lamps: The Electrical Subcontractor shall furnish and install all lamps, both initial and all required replacements until the date of Substantial Completion.
 3. Use of Permanent lighting fixtures.
 - a. Permanent building lighting may be utilized during construction.
 - b. Permanent lighting fixtures which have been used during Construction shall be thoroughly cleaned by the Electrical Subcontractor.
 - c. Immediately prior to the Architect's inspection for Substantial Completion the Electrical Sub-contractor is required to replace all lamps, which are broken, burned out or are producing reduced light output.

July 11, 2018

- B. Protective night lighting is required at all times (24 hours a day, seven days a week). General Contractor is required to arrange for adequate outdoor lighting to illuminate staging, stockpiles, trenches, dangerous projections, excavations and similar conditions and as additionally required to protect the safety of workmen, other personnel, and the public and as an aid in the protection against theft and vandalism.
 - 1. Shield lighting to protect overflow beyond Contract limits, protect neighbors from night light overflow.

1.9 TEMPORARY UTILITIES, TELEPHONE

- A. Temporary telephone service: Provide telephone service at time of project mobilization, and pay all costs for installation, maintenance, and removal. The General Contractor shall pay service charges for local calls; toll charges shall be paid by party who places call. Service and equipment required includes the following:
 - 1. For Owner's Project Representative's/Clerk of Works, Owner and Architect field office area; the General Contractor shall provide:
 - a. One direct line service dedicated for use by the Architect, Owner's Project Representatives, Clerk of Works, the Architect's engineering consultants and other authorized agents of the Awarding Authority.
 - 2. For Contractor's Field Office .
 - a. Provide one direct line service dedicated for use by the Contractor, Filed-Subcontractors, and personnel engaged in construction.
 - b. One answering machine or phone service with messaging.
 - c. Cellular (mobile) phone service for Contractor's Superintendent, continuously maintained until Project Substantial Completion.
 - d. Other instruments at the option of the Contractor
- B. Temporary internet service: Provide internet service at time of project mobilization, and pay all costs for installation, maintenance, and removal. The General Contractor shall pay service charges through date of Substantial Completion.
 - 1. Provide and maintain internet access consisting of digital signal 1 (T1), digital subscriber line (DSL), cable or, Fiber-Optic Service (FiOS) services, (dial-up modem service is not acceptable). Internet service shall include e-mail account allowing a minimum of 5mb attachments to ensure exchange of all construction related e-mail to the Architects/Owner's Representative's Field Office.
 - 2. For Contractor's Field Office, General Contractor shall provide and maintain internet and email service.

1.10 TEMPORARY UTILITIES, WATER

- A. Temporary water: Contractor is permitted to use existing hose bib(s). Owner will pay for water necessary for the Work; exercise measures to conserve water.
 - 1. Contractor is responsible for connections to existing water supply, and any required distribution of temporary water services as required for construction.
 - 2. Protect piping and fittings against freezing.

July 11, 2018

1.11 TEMPORARY HEATING AND COOLING

- A. General, Temporary Heating and Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.
- B. Temporary heat: Unless Owner authorizes use of permanent HVAC system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.
 - 1. Heating Units: UL Listed and labeled for type of fuel being consumed, by a qualified testing agency acceptable to authorities having jurisdiction, and marked for intended location and application.
 - a. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
 - b. Vent heaters directly to outside air, in areas where concrete is less than 15 days old.
 - 2. In enclosed areas, maintain a minimum temperature of 50 degrees Fahrenheit; provide higher temperatures where required by individual specification sections. General Contractor is required to provide enclosures necessary to maintain specified temporary heat.
 - 3. Permanent HVAC System: If Owner authorizes use of permanent HVAC system for temporary use during construction, provide filter with MERV of 8 at each return-air grille in system and remove at end of construction and clean HVAC system. Coordinate with work of Division 23, Heating Ventilating and Air Conditioning (HVAC). Replace all air filters immediately prior to occupancy.

1.12 TEMPORARY VENTILATION AND HUMIDITY CONTROL

- A. General:
 - 1. Humidity Control: Monitor and regulate relative humidity as required for the installation of all interior products. Relative humidity shall be maintained within the limits set by manufacturers of all interior materials and equipment. Refer to individual specification sections in Divisions 6, 8, 9, 10, 11 and 12 for additional environmental requirements.
 - a. Contractor shall enclose interior work areas, protect from weather, and maintain specified temperature and humidity prior to commencement of construction activities relating to interior finishes.
 - 2. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases. Extend and supplement equipment with temporary fan units as required to maintain clean air for construction operations.
 - a. During construction, Contractor shall meet or exceed the minimum requirements of the SMACNA IAQ Guideline for Occupied Buildings under Construction, 2008 edition.
- B. Monitor Humidity: Provide Hygrometer to measure temperature and relative humidity in each construction area.

July 11, 2018

1. Provide dehumidifier(s), as required to maintain humidity of enclosed areas below 70 percent. Humidity level shall be maintained in all areas where interior finish work is being performed, and all areas where interior finishes has been completed.
 2. Provide fans as specified herein, and as required to eliminate significant variation in humidity levels within enclosed spaces.
- C. Temporary Construction Ventilation: Contractor shall maintain sufficient temporary ventilation of areas where materials are being used that emit VOC's and maintain ventilation continuously during installation and until emissions dissipate after installation. If continuous ventilation is not possible via the building's HVAC system(s) then Contractor shall supply ventilation via open windows and temporary fans, sufficient to provide no less than three air changes per hour.
1. Vent all areas directly to outside. Areas shall not be vented to other enclosed areas.
 2. During dust producing activities (e.g. drywall installation and finishing) Contractor shall turn off ventilation system and protect openings in supply and return HVAC system from dust infiltration. Provide temporary ventilation as required.
 3. Dissipation of VOC's: The period after installation shall be sufficient to dissipate odors and elevated concentrations of VOCs. A minimum time period of 72 hours is required except where longer periods of time are specified under individual specification sections.
- D. Preconditioning: Prior to installation, Contractor shall allow products which have odors and VOC emissions to off-gas in dry, well-ventilated space outside of building for 14 calendar days, in order to allow for reasonable dissipation of odors and emissions.

1.13 FIELD OFFICES AND SHEDS

- A. General: Existing facilities shall not be used for field offices and for storage.
1. Availability: Provide at least one job trailers for Contractor's Field Office with space for Clerk of Works, Architect and Owner. Provide offices ready for occupancy within 15 days after date fixed in Notice to Proceed.
 2. Field offices: Provide furnished, insulated, weathertight, office(s) which shall be portable or mobile building(s), or buildings constructed with floors raised above ground, securely fixed to foundations, with steps and landings at entrance doors. Comply with requirements in General Conditions, Article 3-13.
 - a. Securely support trailer on temporary masonry or preservative treated wood piers and not on trailer wheels. Anchor trailer to prevent overturning due to wind or other causes.
 3. Location: The location of the field office(s) and storage areas for equipment and materials shall be upon cleared portions of the job site or areas to be cleared, and shall require review and written acceptance of the Architect/Engineer. Submit plans showing field office and storage facilities for equipment and materials for acceptance by the Architect.

- a. Offices and sheds located within the construction area, or within 30 feet of building lines shall be of noncombustible construction. Comply with requirements of NFPA 241.
 - b. Construction of offices shall have sound insulation adequate to exclude sounds of routine construction activities and reduce server noise to less than 70 dB.
 - c. Access to trailer shall conform to Massachusetts Regulation 521 CMR - Architectural Access Board.
4. General:
- a. Contractor shall provide periodic cleaning and maintenance of field offices and storage areas.
 - b. Provide air conditioning and heating to maintain a temperature range of 65 to 78 degrees F.
 - c. Provide sufficient lighting for 50 foot candles at desk top level over 100 percent of floor area.
 - d. Excluding computer, computer software and related equipment; all other non-consumed furnishings and equipment, will be returned to contractor upon project completion.
- B. Contractor's field office(s): Provide habitable office(s) or space, of size to accommodate personnel, and containing equipment specified under General Conditions, Article 3-13.
- 1. Size: Contractor field office shall be not less than 200 square feet. Sectioning of trailer shall be as required by Contractor.
 - 2. Outdoor weather thermometer.
 - 3. Hard-hats for site visitors.
 - 4. Duplex convenience outlets, at least one per wall.
 - 5. Telephone service as specified herein above.
 - 6. Other equipment and furniture as the Contractor deems necessary, in addition to equipment and furnishings specified under the General Conditions for use by Architect's Resident Engineer/Clerk of Works, Architect, and Owner.
- C. Storage and fabrication sheds: Provide as required, sheds, equipped to accommodate materials and equipment involved.
- 1. Subcontractor's are responsible for their own storage facilities, coordinate locations.
- D. Maintain approach walks to field office and storage/fabrication sheds free of mud, water, and snow.
- E. When permanent facilities are enclosed with operable utilities, relocate offices and storage into building, with written agreement of Owner, and remove temporary buildings.
- 1.14 SANITARY FACILITIES
- A. Sanitary facilities: Provide self-contained single-occupant chemical toilet units, wash facilities and drinking water fixtures.

July 11, 2018

1. Existing facilities located in the building may not be used by the Contractor's personnel.
 2. Permanent facilities located in completed work may not be used by the Contractor's personnel.
 3. Locate sanitary facilities within the fenced construction zone.
- B. Provide toilet tissue, paper towels, paper cups, cleaning compounds and similar materials.
- C. Maintain facilities, through-out term of construction, and keep clean, provide covered waste containers for used material.
- 1.15 CANTEEN SERVICES
- A. Canteen vehicles must access the worksite at predetermined times coordinated with the Owner, and are limited to service within the construction site only.
- 1.16 FIRST AID AND FIRE EXTINGUISHERS
- A. First aid supplies: Comply with governing regulations.
- B. Fire extinguishers: Provide and maintain on site, adequate fire extinguishers UL rated for A-B-C type fires. Provide red-painted plywood standards for each extinguisher. Additionally, provide a dry chemical fire extinguisher at each location where welding, torch cutting and other similar hazardous work is in progress.
1. At welding and heat cutting work: Provide not less than a Multi-purpose dry chemical type (mono ammonium phosphate) fire extinguisher, 20-pound capacity, multi-purpose rated "2A, 120 B:C".
- 1.17 CONSTRUCTION AIDS - TEMPORARY HOISTS AND CRANES
- A. Hoisting equipment and machinery: Furnish all hoisting equipment, crane services and lift machinery required to perform the Work of this Contract, except that required by Filed-subcontractors. Install, operate and maintain in safe condition.
1. Do not charge applicators and installers for these services during normal working hours.
 2. Filed Subcontractors are responsible for their own hoisting equipment, crane services and lift machinery required to perform the Work of their respective trade.
- 1.18 CONSTRUCTION AIDS - SCAFFOLDING, PLATFORMS, STAGING, CHUTES
- A. Provide all ladders, ramps, runways, platforms, railings, chutes, and other mounted or installed construction aids as specified herein and as required to facilitate the Work. Furnish and erect construction aids and maintain in safe condition for the use of all subcontractors, installers and applicators.
- B. Furnish and erect scaffolds, staging, and maintain in safe condition, dismantle when no longer required. The General Contractor and Filed Subcontractors shall provide scaffolds, staging, and other similar raised platforms, required to access the Work., per the following guidelines:

1. Scaffolding required for used by Filed Subcontractors, 8 feet in height and less, shall be furnished, erected, maintained, and dismantled, by the Filed Trade requiring such scaffolding.
 2. Scaffolding required for used by Filed Subcontractors, above 8 feet in height shall be furnished, erected, maintained and dismantled by the General Contractor.
 3. Scaffolding of any height, required for used by installers and applicators of non-filed trades, shall be furnished, erected, and maintained by the General Contractor.
 4. General Contractor is responsible to provide, maintain and remove when no longer required, all tarpaulins and enclosures necessary to cover scaffolding (including that furnished by Filed Subcontractor) to maintain specified temporary heat as specified herein under Article entitled "TEMPORARY WEATHER PROTECTION" from the dates of November 1 to March 31.
- C. Ladders, temporary stairs, platforms and railings, shall comply with OSHA guidelines.
1. Provide and maintain temporary stairs until permanent stairs are in place and functional. When permanent stairs are erected, provide temporary railings and guards. Protect permanent stairs with temporary covers and protective treads.
 2. Portable ladders and mobile platforms of all required heights, shall be provided by individual users.
- D. Temporary chutes: Provide, erect, and maintain properly supported and covered chutes from openings in exterior walls of each building level in convenient and accessible locations for use of all trades, that will permit direct disposal of rubbish and debris directly into trucks or disposal units.
1. Do not drop or throw any materials, rubbish, or debris from openings in the exterior walls of the project, or from roof.
- 1.19 VEHICULAR ACCESS AND PARKING
- A. Provide and maintain access to fire hydrants free of obstructions. Provide unimpeded access for emergency vehicles. Maintain 20 foot width driveways with turning space between and around combustible materials.
- B. Snow and ice removal: Maintain all vehicular and pedestrian access roads and walkways free from ice and snow during the winter season for the duration of the Project.
- C. Vehicular Parking: Some on-site parking spaces will be made available for the Contractor's use, however the on-site parking may not be sufficient for all of the Contractor's and subcontractor's employees.
1. Arrange for off-site parking areas to accommodate construction personnel.
 2. Parking on public streets: Limited On-street parking is available. The Contractor's personnel are fully responsible to abide by all Municipal Laws and Regulations for on street and public parking. The Contractor and its personnel are additionally fully responsible for all costs incurred by the Contractor or its personnel for parking.

July 11, 2018

- D. Prior to Substantial Completion, the installed base for permanent roads and parking areas may be used for construction traffic.
 - 1. Avoid traffic loading beyond paving design capacity.
 - 2. Permanent parking structures and final paved areas may be used by construction personnel on execution of agreement with Owner.

1.20 VEHICULAR TRAFFIC CONTROL

- A. The Contractor shall not close or obstruct any portion of any street public or private, without obtaining permits therefore from the proper authorities.
 - 1. Provide and pay for police traffic details at anytime that construction takes place in a public street (right of way). The Contractor is responsible for coordinating, requesting, and paying the prevailing rate of wage for police traffic details directly with the Town of Halifax Police Department.
 - 2. Provide and pay for traffic details at anytime that construction takes place in a public street (right of way). The Contractor is responsible for coordinating, requesting, and paying for traffic details.
- B. Construction parking control: Control vehicular parking to preclude interference with public traffic or parking, access by emergency vehicles, Owner's operations, or construction operations.
 - 1. Monitor parking of construction personnel private vehicles in existing facilities. Maintain free vehicular access to and through parking areas. Prohibit parking on or adjacent to access roads, or in non-designated areas.
- C. Vehicle and Equipment Security: Lock all unattended vehicles including construction machinery and equipment. Do not leave vehicles or equipment unattended accessible to public with the motor running, or with keys easily accessible.
- D. Haul routes: Consult with governing authorities and establish public thoroughfares which will be used as haul routes and site access. Confine construction traffic to designated haul routes.
 - 1. Confine construction traffic to designated haul routes.
 - 2. Provide traffic control at critical areas of haul routes to expedite traffic flow and to minimize interference with normal public traffic.
- E. Traffic signals and signs: Provide, operate and maintain temporary equipment, services, and personnel, with traffic control and protective devices, as required to direct and maintain an orderly flow of traffic in all areas under Contractors control, or affected by Contractors operations, including but not limited to haul routes, at site entrances, at on-site access roads, and parking areas during construction.
 - 1. Provide traffic control and directional signs as needed to direct construction and public traffic.
 - 2. Provide warning signs for public traffic and "STOP" signs for entrance onto public roads.
 - 3. Comply with signage and traffic control requirements of authorities having jurisdiction.

July 11, 2018

1.21 DUST CONTROL

- A. Provide positive means to prevent air-borne dust from dispersing into atmosphere.
 - 1. Take all necessary measures and provide equipment and materials to minimize dust from rising and blowing across the site and also to control surface water throughout the operation so that it does not run onto paved ways without being filtered. Control all dust created by construction operations and movement of construction vehicles, both on site and on paved ways.
 - 2. During the progress of the work, maintain the areas of construction activities including sweeping and sprinkling of streets as necessary. Provide and use calcium chloride for more effective dust control, when deemed necessary by regulatory agencies, without additional cost to the Owner.
- B. Prevent air-borne dust from dispersing into ducts (air supply and return) during construction. Seal all open ends of completed ductwork, and overnight work-in-progress. Inspect ducts on daily basis to ensure seals are intact. Protect ductwork waiting to be installed with surface wrapping.
 - 1. Ductwork protection during construction is a joint responsibility between the General Contractor and HVAC Filed subcontractor.
 - 2. HVAC Filed subcontractor is responsible to wipe down internal surfaces of ductwork immediately prior to installation to remove all dust and debris.
- C. Prevent air-borne dust from dispersing into occupied spaces (after partial Owner-occupancy, if occurs). Provide interior dust-tight temporary partitions as specified under the Article entitled "Interior enclosures".
 - 1. Provide air-filters over openings and grilles in air-return ducts occurring within construction areas.
 - 2. Provide openings in temporary partitions where air-return grilles occur outside of work areas. In each opening, provide standard 2 inch thick, throw-away type filter having a rated efficiency of 35 percent. Review with Architect size requirements of filtered openings, locations of openings and how many are required.
 - 3. Replace air filters as required to maintain their efficiency.

1.22 NOISE CONTROL

- A. Develop and maintain a noise-abatement program and enforce strict discipline over all personnel to keep noise to a minimum.
- B. Execute construction work by methods and by use of equipment which will reduce excess noise.
 - 1. Equip air compressors with silencers, and power equipment with mufflers.
 - 2. Manage vehicular traffic and scheduling to reduce noise
- C. Interior work involving cutting, drilling, hammering or noise generating procedures shall be completed during times scheduled with the Owner in advance.

1.23 TEMPORARY WEATHER PROTECTION

- A. Protect building interior and all materials and equipment from weather at all times. Where removal of existing roofing, roof sheathing, windows, doors, and other items

is necessary to accomplish work, have materials and workmen ready to provide adequate and approve temporary covering of exposed areas.

1. Temporary coverings shall be attended as necessary to insure effectiveness and to prevent displacement.
2. Contractor shall repair or replace all elements of the building damaged by failure to properly protect them from the weather to the satisfaction of the Architect at no additional cost to the Owner.

1.24 TEMPORARY INTERIOR (ISOLATION) ENCLOSURES

- A. Provide temporary partitions and ceilings to separate work areas from Owner's occupied areas, to prevent penetration of dust and moisture into Owner's occupied areas and to prevent damage to existing materials and equipment.
 1. Temporary enclosures must seal construction areas and prohibit passage of dust and debris, and inhibit noise transmission.
 2. Temporary enclosures and doors through them, shall be erected in manner to provide code mandated egress from the occupied portions of the building. Provide fire-resistant rated enclosures where required to maintain protected paths of egress.
- B. Construction: Wood framing with gypsum board sheet materials with closed joints and sealed edges at intersections with existing surfaces.
 1. Performance:
 - a. Minimum STC rating (per ASTM E90): 35.
 - b. Maximum Flame Spread Rating of exposed surfaces (per ASTM E84): 75 or less.
 2. Construct closures, using new materials only, in accordance with the general requirements in Section 06 10 00 – Rough Carpentry and Section 09 29 00 - GYPSUM BOARD.
 3. Studs, Tracks and Runners: Lumber for blocking, nailers and curbs as indicated or required: Hem-Fir, Douglas Fir, Eastern Spruce, Eastern Hemlock, or Southern Pine, surfaced dried stud or utility grade.
 - a. Minimum stud size:
 - 1) Partition height up to 10'-0": nominal 2 by 4 inches.
 - 2) Partition height over 10'-0": nominal 2 by 6 inches.
 - b. Studs installed at not greater than 24 inches on center.
 4. Gypsum Board: standard (non-rated) board, complying with ASTM C1396 (Section 5) and ASTM C36, minimum 1/2-inch thickness.
 - a. Where 1-hour fire-resistant rating is required Provide single layer of Type X board on both sides of framing. Gypsum board shall comply with ASTM C1396 (Section 5) and ASTM C36, 5/8-inch thickness.
 - b. Where 2-hour fire-resistant rating is required Provide double layer of Type X board on both sides of framing. Gypsum board shall comply with ASTM C1396 (Section 5) and ASTM C36, 5/8-inch thickness.
 5. Gypsum Board Finishing: Taped and compounded joints, provide metal corner bead at transitions of plane, and metal J bead at partition edge perimeter (including tops, bottoms and where abuts dissimilar materials).

- a. Finish: comply with GA-214 and GA-216: Level 4 where exposed to public, and Level 1 facing construction area.
- C. Door openings within temporary partitions:
 - 1. Size:
 - a. Doors for materials and man access; provide opening 6'-0" width by 6'-8" height, with double doors.
 - b. Doors for man access only: opening 3'-0" width by 6'-8" height.
 - 2. Provide lockable double door entrances with pressed metal frames, 1-3/4 inch thick solid core wood doors, or hollow metal doors. Provide rated doors and frames where fire-resistant ratings are required.
 - a. Provide all doors with self-closing hardware and locks.
- D. Door openings within temporary partitions:
 - 1. Size:
 - a. Doors for materials and man access; provide opening 6'-0" width by 6'-8" height, with double doors.
 - b. Doors for man access only: opening 3'-0" width by 6'-8" height.
 - 2. Provide lockable double door entrances with pressed metal frames, 1-3/4 inch thick solid core wood doors, or hollow metal doors. Provide rated doors and frames where fire-resistant ratings are required.
 - a. Provide all doors with self-closing hardware and locks.
- E. Paint surfaces exposed to view in User Agency occupied or public accessible Owner occupied areas.
 - 1. Primer:
 - a. Doors and Frames: DTM metal primer.
 - b. Partitions: One coat latex primer (compatible with finish paint).
 - 2. Finish Paint (all surfaces): Two coats latex eggshell paint, white color, except as otherwise directed by Architect.
 - a. California: "Pacific Eggshell", N°. 561.
 - b. Glidden Professional: Ultra-Hide 150 Eggshell N°. 1412.
 - c. Moore: "SuperSpec Green Eggshell", 781 Series.
 - d. Pittsburgh:"Speedhide Interior Latex Eggshell", 6-411 Series.
 - e. Sherwin-Williams: "Eggshell Enamel No. 274 ".

1.25 TEMPORARY PROTECTION OF EXISTING FINISHES

- A. General: Take all required measures to protect the existing building (contents, surfaces, or materials) and site from damage of any kind when performing the Work.
 - 1. Take any special steps necessary to protect entrances and areas around building and to prevent persons from coming in contact with material or construction operations.
 - 2. Protect utility services, pavements, sidewalks, landscaping, and all other site elements scheduled to remain.

July 11, 2018

- B. Provide all temporary protections as may be required to ensure that all components of existing building indicated to remain are not damaged during the execution of the Work.
 - 1. Protection may be required to remain in place for the duration of the project. As such, materials should be installed to provide adequate protection throughout the full extent of construction activities. Repair or reinstall protection throughout the duration of construction as required.
- C. Dust Protection Path: Areas where demolition work is required.
 - 1. Seal all floor, wall and ceiling openings to prevent the intrusion of dust into these spaces. Provide dust curtains at doors.
 - 2. Construct temporary partitions surrounding the area of construction in these areas.
 - 3. Dust-Proof Wrap: Cover surfaces with polyethylene plastic. Seal seams completely with duct tape. Anchor to protection wherever possible. Attach to historic materials with preservation tape. Do not use duct tape or mechanical fasteners on historic materials.
 - 4. Dust-Proof Temporary Partitions: Comply with Article above entitled TEMPORARY INTERIOR (ISOLATION) ENCLOSURES.

1.26 TEMPORARY BARRICADES

- A. Provide barriers and barricades to prevent unauthorized entry to construction areas.
 - 1. Comply with standards and code requirements for erection of barricades, where required provide lighting, including flashing lights.
 - 2. Paint with appropriate colors, graphics and warning signs to inform personnel and the public of the hazard being protected against.
 - 3. Provide special barriers necessary to protect entrances and areas around building and to prevent persons from coming in contact with material or construction operations.
- B. Provide temporary enclosures, as required, for protection of existing facilities and new construction from exposure to weather, other construction operations and similar activities. Where heat is needed and the building envelope is incomplete, provide enclosures where there is no other provision for containment of heat.
 - 1. Provide doors with self-closing hardware and locks.
- C. Provide temporary roofing as needed to maintain the building water tight.

1.27 TEMPORARY FENCES

- A. Construction fence: Provide a 8 foot high commercial grade chain link fence around construction site; equip with vehicular and pedestrian gates and locks.
 - 1. Relocation of all fences and gates as required due to construction phasing. Relocations shall be provided at no additional cost to the Owner.
 - 2. Vehicular and Pedestrian Gates: Build into fence at approved locations. Provide gates with cross-bracing, and hung on heavy strap hinges with post and hook for double gates. Provide heavy hasps and padlocks.

July 11, 2018

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- B. Emergency Key Cabinet: Provide emergency access key cabinet ("Knox Box"): medium duty, surface mounted. Locate emergency key cabinet in readily-accessible location outside of fence line. Coordinate keying with Town of Halifax Fire Department. Provide keys for emergency key cabinet to Owner's designated representative(s).
1. Inside emergency key cabinet maintain keys for fence entrance gates, and construction core keys for building, once it is closed in.
- C. Fence, General: Fence shall be industrial-grade, heavy-duty construction: Galvanized fabric with galvanized frame.
1. Chain link fabric shall be made of coated-steel, 9 gage (0.148 inch) core wire woven in 2-inch uniform mesh, height (roll width) to suit fence height, with bottom selvage knuckled, top selvage twisted, with woven fabric having a minimum breaking strength of 1290 pounds.
 - a. Construction privacy and containment mesh: 80 to 85 percent privacy (15 to 20 percent open) 100 percent polyethylene mesh having weight of approximately 5.1 ounces per square yard, color green. Provide with four-ply sewn hems, reinforced with 2 inch wide 18 ounce vinyl-coated UV resistant polyester tape. Finish hem width is 1 inch. Furnish with number 2 size brass grommets at 12 to 18 inches on-center, along hemmed edges.
 - 1) No advertising signage, logos or graphics are permitted on screening.
 2. Framework: Type 1 seamless steel pipe, ASTM A-120, standard weight schedule 40, hydrostatic testing waived.
 3. Gate Posts: Standard weight pipe 2-7/8 inches OD nominal weight, 5.79 pounds per foot.
 4. Gate Frames: 2 inches OD standard weight pipe, 2.73 pounds. per foot with heavy malleable iron or pressed steel corner fittings securely riveted. Fabric to match the fence shall be installed in the frame by means of tension bars and hook bolts. Each frame to be equipped with 3/8 inches diameter adjustable truss rods.
 5. Bottom hinges to be ball and socket type designed to carry the weight of the gate on the post footing. Upper hinge to be wrap around adjustable type. All gates to be equipped for padlocking and with semi-automatic outer catches to secure gates in opened position.
 6. Fittings: Pressed steel or malleable iron, hot-dipped galvanized conforming to the requirements of ASTM A153. Tie wires shall be minimum nine-gage galvanized wire,. Attachment bolts shall be galvanized.
 7. Post Settings: Driven into ground. Temporary concrete bases may be considered where fencing is scheduled for relocation.

1.28 TREE AND PLANT PROTECTION

- A. General: Comply with requirements specified in Divisions 31 and 32, in addition to those specified herein.
- B. Existing Trees and Vegetation: Protect existing trees and other vegetation indicated to remain in place against unnecessary cutting, breaking or skinning of roots, skinning or bruising of bark, smothering of trees by stockpiling construction

materials within drip line, excess foot or vehicular traffic, or parking of vehicles within drip line.

- C. Provide temporary guards to protect trees and vegetation to be left standing. Protect plant life by placing boards, planks, poles or fencing around them.
- D. Water trees and other vegetation to remain within limits of contract work as required to maintain their health during course of construction operations.
- E. Soil: Protect soil from contamination with toxic materials that are detrimental to plant growth.
- F. Provide protection for roots over 1-1/2 inch in diameter that are cut during construction operations. Coat cut faces with an emulsified asphalt or other acceptable coating formulated to use on damaged plant tissues. Temporarily cover exposed roots with wet burlap to prevent roots from drying out; cover with earth as soon as possible.
- G. Repair or replace trees and vegetation indicated to remain that are damaged by construction operations in a manner acceptable to Architect.
 - 1. Plant life or landscape feature scarred or damaged by the Contractor's equipment or operations shall be restored as nearly as possible to its original condition at the expense of the Contractor.
 - 2. Employ a licensed arborist to repair damage to trees and shrubs. Replace trees that cannot be repaired and restored to full-growth status.
 - a. The Architect/Engineer will decide whether damaged trees shall be treated, or be removed and replaced.
- H. A reasonable sum (cost of equivalent replacement) will be deducted from the Contract Sum for any permanent damage to existing trees or plantings which are outside the construction site area but on the Owner's property or within the construction site area, and areas designated to be protected. Damage to trees and plants off the Owner's property shall be fully the responsibility of the General Contractor.

1.29 POLLUTION CONTROL

- A. Provide methods, means, and facilities required to prevent contamination of soil, water, or atmosphere by, the discharge of noxious substances from construction operations.
 - 1. Comply with all applicable Federal, State, County, and municipal laws regarding pollution.
 - 2. Prevent pollution of streams, lakes, or reservoirs with fuels, oils, bitumens, calcium chloride, acids, waste products, effluents, chemicals or other harmful substances. Prevent from such substances from entering storm drains and sanitary sewers.
- B. Provide equipment and personnel, perform emergency measures required to contain any spillage and to remove contaminated soils or liquids.
 - 1. Excavate and legally dispose of any contaminated earth off-site, and replace with suitable compacted fill and topsoil.

July 11, 2018

1.30 FIRE PREVENTION MEASURES

- A. Prior to commencement of work at the site, the Owner's Representative, Construction Manager, and General Contractor shall meet with the Local Fire Marshal to plan site and building access in the event of fire.
 - 1. Access paths for heavy fire fighting equipment shall be laid out and maintained.
 - 2. Free access from streets to fire hydrants and to outside connections for standpipes, sprinklers or other fire extinguishing equipment shall be provided and maintained.
- B. The Contractor shall take all necessary precautions for the prevention of fire during construction. Install and maintain temporary fire protection facilities of the types needed to protect against reasonably predictable and controllable fire losses. Maintain unobstructed access to fire extinguishers, fire hydrants, temporary fire protection facilities, stairways, and other access routes. Ascertain and comply with requirements of Project insurance carrier, local fire department and the state fire marshal.
 - 1. Maintain the area within contract limits orderly and clean.
 - a. Remove combustible rubbish promptly from the site and when required, store combustible materials in containers in fire-safe locations.
 - 2. Maintain clear access to exits from within the building.
 - 3. Smoking is not permitted in the building or on the job site.
- C. Establish procedures for fire protection for welding, cutting and open torch work, and other potentially hazardous operations. Obtain permission from local authorities having jurisdiction for such work as required by law. Provide special fire extinguishers at welding and torch cutting work.
 - 1. Maintain a fire watch when existing fire protection and warning systems have been temporarily de-activated. Maintain watch during all working hours for full period of de-activation.
 - 2. The Contractor will assign personnel to inspect all construction areas at the end of each day's work for fire hazards prior to lock-up.
- D. Provide for outside storage of gas tanks, sufficiently clear of any structure. Promptly remove welding and cutting equipment from the building when no longer required. Do not store welding or cutting materials within the building when work is not being performed.
- E. Permanent fire protection system may be activated to meet these requirements. Replace fusible link heads and other expended or discharged components at time of Substantial Completion.
- F. Open Flame: Cutting and welding torches will be allowed **only** under the following conditions:
 - 1. Contractor shall provide continuous and adequate supervision, fire watches, and emergency fire protection apparatus to assure that sparks or drops of hot metal do not start fires.
 - 2. The following pre-conditions are required at each location where cutting or welding is to occur, prior to commencement of cutting or welding work.

- a. Each area where cutting or welding work is to occur shall be completely cleared of all flammable materials.
 - b. Designated fire watch personnel with extinguishers shall be posted at the work areas for the duration of the work, and for 30 minutes after completion of work.
 - c. At each location where cutting or welding work occurs, provide a 20 pound capacity, multi-purpose ABC rated extinguisher.
 - d. Cutting and welding operations shall cease 2 hours prior to the close of construction (each day) to minimize the risk of undetected smoldering fire.
3. A new permit shall be required each day, issued by the Owner's designated representative, for each location where cutting or welding is to occur. A permit will not be issued until the following conditions are satisfied:
- a. The work area is completely cleared of flammable materials.
 - b. Fire watchers with extinguishers are posted for the duration of the work and for 30 minutes after completion of work.
 - c. Cutting and welding operations cease 2 hours prior to the close of construction each day to minimize the risk of undetected smoldering fire.
- G. Paint Removal Devices: The use of open flame devices, heat plates, and hot air guns to remove paint shall be prohibited.

1.31 SECURITY MEASURES

- A. Protect Work, existing premises and Owner's operations from theft, vandalism, and unauthorized entry. Maintain security program throughout construction period until Owner occupancy precludes the need for Contractor security.
1. General contractor is responsible for security of site during construction, including prevention of illegal trespassing, unauthorized entry, theft and vandalism. All losses and damages which occur are the full responsibility of the General Contractor, who shall bear all costs incurred.

1.32 PROJECT IDENTIFICATION AND TEMPORARY SIGNAGE

- A. General: Signs other than those specified herein are not permitted, except those required by law or expressly authorized by the Awarding Authority .
1. At all times during the project, signage must clearly direct occupants and the general public in the safe use of the building. Signs must clearly indicate areas of no admittance, and further must clearly define and direct users to building entries, exits, and other important destinations.
 - a. All such interim signage must be painted by a professional sign painter on 3/4-inch medium density overlay plywood with letters no less than 3 inches in height.
 - b. Coordinate required signage with Architect/Engineer.
- B. Project sign:
1. Provide 8 foot wide by 4 foot high foot project sign of exterior grade MDO plywood and wood frame construction, painted, with self-adhesive color

printed text with reproduction of building rendering. Architect will provide signage design.

- a. Color prints for rendering shall be 3M Scotch print marking film series 8640 or equal, 4 mil thickness, "ControlTac" vinyl film as manufactured by 3M company having a position able pressure activated pigmented adhesive.
 - b. Overlay protecting film, Scotchprint Film, clear over laminating film, as manufactured by 3M company.
2. List title of project, names of Awarding Authority, Owner, User Agency, Architect/Engineer, professional sub-consultants, Contractor, and major Filed-subcontractors.
 3. Erect on site at location established by Architect/Engineer.
- C. Signage at perimeter of construction site: Provide clear and visible warning signage with appropriate language such as: "Prohibited Access – Hard Hat Only – No Admittance – Authorized Personnel Only".

1.33 REMOVAL OF TEMPORARY UTILITIES, CONTROLS, AND FACILITIES

- A. Remove temporary materials and construction prior to Substantial Completion.
- B. Restore existing facilities used during construction to original conditions. Restore permanent facilities used during construction to specified condition.
- C. Clean and repair damage caused by installation or use of temporary work.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

End of Section

Section 01 60 00
PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Definition of Terms
- B. Basic product requirements.
- C. General environmental requirements for products.
- D. Owner furnished products.
- E. Product delivery and handling requirements.
- F. Product storage and protection requirements.

1.2 RELATED REQUIREMENTS

- A. Section 01 25 13 - PRODUCT SUBSTITUTION PROCEDURES:
 - 1. Product options.
 - 2. Product substitution procedures.

1.3 DEFINITION OF TERMS

- A. "Products" is defined as new material, machinery, components, equipment, fixtures, and systems used in the Work. Products do not include machinery and equipment used for preparation, fabrication, conveying and erection of the Work. Products may also include existing materials or components required for re-use.
- B. "Materials" are products that are shaped, cut, worked, mixed, finished, refined or otherwise fabricated, processed, or installed to form a part of the Work.
- C. "Equipment" is a product with operational parts, whether motorized or manually operated, that requires service connections such as wiring or piping.
- D. "Fasteners" include all products required for mechanical connections and include, but are not limited to: nails, screws, bolts, expansion bolts, chemical bolts, epoxy anchors, pins, powder-actuated devices, and similar fasteners, anchors, and connections.
- E. Definitions in this article are not intended to negate the meaning of other terms used in Contract Documents, including "specialties", "systems", "structure", "finishes", "accessories", "furnishings", "special construction", and similar terms, which are self-explanatory and have recognized meanings in the construction industry.

1.4 BASIC PRODUCT REQUIREMENTS

- 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. Do not use materials and equipment removed from existing premises, except as specifically permitted by the Contract Documents.
- B. To the fullest extent possible, provide products of the same kind, from a single source.
- C. Provide interchangeable components of the same manufacturer, for similar components.
- D. When the Contractor has the option of selecting two or more products, ensure that products selected shall be compatible with products previously installed or approved.
- E. Provide all products complete with all accessories, trim, finish, safety guards and other devices and details needed for a complete installation and for the intended use and effect.
- F. Galvanic Corrosion: Install materials in manner which will effectively isolate dissimilar metals which may potential for galvanic corrosion. Use non-absorptive dielectric material, isolation coatings, or other protective isolator approved by Architect.
- G. Fasteners, Anchors, and Connections: Provide all fasteners, anchors, and connections needed to safely, securely, and appropriately secure all Work permanently in place.
 1. General: The Contractor is solely responsible for the capacity, suitability, adequacy, and safety of all welded, fastened and anchored connections.
 - a. Comply with applicable code requirements regarding fastener selection and installation.
 - b. Provide at least two fasteners for each individual item being fastened.
 - c. Utilize fastener manufacturer's published load tables for working loads to assist in determining fastener size and space. Do not use ultimate load capacity in determining fastener selections.
 - d. Provide a minimum safety factor of 4.
 - e. Select and utilize fasteners having minimum galvanic corrosion factor.
 - f. Hydrogen embrittlement prevention:
 - 1) Do not use high-strength and low-alloy fasteners which have been subjected to an acid pre-treatment (because they can become brittle and fail), utilize instead equivalent capacity and size bi-metal, stainless steel or high strength aluminum fasteners, as appropriate to the conditions and materials where being used.
 - 2) Utilize low-hydrogen electrodes for welding high-strength steels to prevent hydrogen embrittlement.
 2. To permit the Contractor control over means and methods, some fastener conditions may not be fully defined in the Contract Documents. In particular, individual specification sections that require delegated independent engineering. In such instances the Contractor is fully responsible to determine method of fastening appropriate for each condition. The Contractor shall take into consideration substrate material(s) and product(s) being fastened, live and dead loading, and both atmospheric and visual exposure considerations.

Contractor is responsible to determine fastener type, material, finish, size, diameter, length and spacing.

3. Torque structural fasteners as recommended by fastener manufacturer, or as otherwise specified in the Contract Documents.

H. Permanent Labels and Nameplates:

1. Restrictions:
 - a. Do not provide exposed-to-view labels, nameplates, or trademarks which are not required by code, or regulations.
 - b. Do not expose manufacturers, suppliers, or installer's name, logo, or trade names on normally visible surfaces.
 - c. Do not provide labels, nameplates or trademarks when individual specification sections specifically exclude them.
 - d. All exposed-to-view advertising and name-brand labels shall be fully removed without damage to substrate finish.
2. Location for required labels: Required labels, approval plates and stamps shall be located on a concealed surface, or where required for observation after installation on accessible non-conspicuous surface.
3. Data Plates: Provide permanent data plate on each item of service-connected or power-operated equipment.
 - a. Data Plate Information: Include manufacturer, model, serial number, date of manufacture, capacity, ratings, power requirements, and all other similar essential data.
 - b. Locate data plates on easily accessible surface that is inconspicuous in occupied spaces.

1.5 GENERAL ENVIRONMENTAL REQUIREMENTS FOR PRODUCTS

- A. General: Prohibit the use of or incorporation into the work of materials which contain toxic, hazardous and harmful materials.
 1. Hazardous materials: Defined as pesticides, biocides, and carcinogens as listed by recognized authorities, such as the Environmental Protection Agency (EPA), the International Agency for Research on Cancer (IARC) or regulated under OSHA Hazard Communication Standard, 29 CFR 1910.1200.
 2. Harmful materials: Defined as materials which contain the presence of chemical, physical, or biological elements or agents which adversely affect human health or welfare; unfavorably alter ecological balances; or degrade the utility of the environment for aesthetic, cultural, or historical purposes.
 3. Owner restricted materials: Defined as all products to which the Owner has a reasonable objection because of its content, composition, properties, or characteristics.
- B. Vapors, Gases, Fumes, Odors:
 1. General: Comply with all state and federal VOC requirements. Where ever possible use non-VOC materials.
 - a. Limit use of products to the greatest extent possible which have "off-gassing", fumes, flammability, and other harmful characteristics.

- 1) Prohibit use of products which contain substances that contribute significantly to the production of photochemical smog, tropospheric ozone, or poor indoor-air quality.
 - b. Limit use of ozone-depleting compounds to the greatest extent possible. An ozone-depleting compound is any compound with an ozone-depletion potential greater than 0.01 (CFC 11 = 1).
 - c. Use organic and biodegradable cleaners to the greatest extent possible.
 - 2. Do not install, use for installation, and use for cleaning those materials which may produce objectionable (to Owner and public) vapors, gases, fumes, odors, or similar conditions.
 - 3. Do not install or use products which may have possible chemical or biological reactions with other on-site materials.
- C. Toxicity of prefabricated wood products (composite wood and agrifiber products): Products shall contain no added urea-formaldehyde resins.
 - 1. Laminating adhesives used to fabricate on-site and shop-applied composite wood and agrifiber assemblies shall contain no added urea-formaldehyde resins.
- D. Adhesives: Provide adhesives approved by the manufacturers of the products being adhered which are Low-VOC or non-VOC, non-flammable, water-proof after cured, odor free.
 - 1. Comply with Commonwealth of Massachusetts Adhesives and Sealants Regulations 310 CMR 7.18 (30).

1) Outdoor floor covering adhesives	250
2) Non-membrane Roof Installation and Repair Adhesive	300
3) Single-ply Roof Membrane Roof Installation and Repair Adhesive	250
4) Thin-Metal Laminating	780
5) Waterproof Resorcinol Glue	170
6) Flexible Vinyl	250
7) Rubber	250
8) Other Substrates	250

 - b. Adhesive Primers VOC Limit [g/L less water]

1) Plastic Cement Welding	650
2) Single-ply Roof Membrane	250
3) Traffic Marking Tape	150
4) Other	250
- E. Carpet systems: Refer to Section 09 68 00 - Carpeting for VOC requirements.
- F. Interior Paints: Provide products that comply with specified VOC limits, refer to Section 09 91 00 – PAINTING for additional requirements.
- G. Sealants: Provide products that comply with specified VOC limits. Comply with Commonwealth of Massachusetts Adhesives and Sealants Regulations 310 CMR 7.18 (30). Refer to Section 07 92 00 – JOINT SEALANTS, and as specified herein, for additional requirements.

1. Only use sealants and primers that comply with the following limits for VOC content:

a. Sealants	VOC Limit [g/L less water]
1) Architectural	250
2) Single-Ply Roof Membrane	450
3) Non-membrane Roof	300
4) Roadway	250
5) Marine Deck	760
6) Other	420
a. Sealant Primers	VOC Limit [g/L less water]
1) Architectural Non Porous	250
2) Architectural Porous	775
3) Marine Deck	760
4) Other	750

- H. Safety Data Sheets (SDS) {formerly Material Safety Data Sheets, MSDS: Obtain and maintain on-site record data sheets for each product brought onto the Site.
 1. Maintain an organized file of Material Safety Data Sheets at the job-site for quick reference.
 2. Furnish SDS for all finishes, paints, coatings, curing compounds, sealers, adhesives, mastics, waterproofing, dampproofing, sealants, cleaning chemicals, carpets, upholstery, fabrics and all similar products.
- I. Cleaning and maintenance products:
 1. Provide data on manufacturers' recommended maintenance, cleaning, refinishing and disposal procedures for materials and products utilized. These procedures are for final Contractor cleaning of the project prior to substantial completion and for provided materials and products as required by the specific specification sections.
 - a. Where chemical products are recommended for these procedures, provide documentation to indicate that no component present in the cleaning product at more than 1% of the total mass of the cleaning product is a carcinogen or reproductive toxicant as defined in the lists in this specification section.
 - b. For purposes of reporting, identification of product VOC contents shall not be limited to those regulated.
 2. Avoid cleaning products containing alpha-pinene, d-limonene or other unsaturated carbon double bond alkenes due to chemical reactions with ozone to form aldehydes, acidic aerosols, and ultra fine particulate matter in indoor air.
- J. Establish written Contractor's safety and emergency response procedures for safety precautions, accidents, emergency conditions, and clean-up methods.

1.6 OWNER FURNISHED PRODUCTS

- A. Owner Furnished Products: As provided in the General Conditions, the Owner will provide products by others under a separate agreements.
 1. Owner's responsibilities regarding Owner furnished products:

- a. Arrange for and deliver Owner reviewed shop drawings, product data, and samples to Contractor.
 - b. Arrange and pay for product delivery to site.
 - c. On delivery, inspect products jointly with Contractor.
 - d. Submit claims for transportation damage, and replace damaged, defective, or deficient items.
 - e. Arrange for manufacturers' warranties, inspections, and service agreements.
2. Contractor's responsibilities regarding Owner furnished products:
- a. Review Owner reviewed shop drawings, product data, and samples to Contractor.
 - b. Handle, store, and provide temporary protection.
 - c. Repair or replace items damaged after receipt.
 - d. Provide protection of installed work.
 - e. When not installed under this Contract, the Contractor shall coordinate Owner installed work with interfacing work of this Contract. The Contractor shall provide temporary protection and final cleaning of Owner installed products, except as directed otherwise.
3. Items noted in Drawings as "Not in Contract" or "N.I.C.", identify work or products which either exist, or are furnished by Owner; such work requires coordination with the Work of this Contract and may even require installation by this Contractor.
- B. The Contractor has coordinating responsibility for Testing laboratory services as identified under Section 01 45 29 - TESTING LABORATORY SERVICES and as specified under individual specification sections.

1.7 PRODUCT DELIVERY AND HANDLING REQUIREMENTS

- A. Transport and handle products in accordance with manufacturer's instructions and as specified in individual specification sections.
1. Ductwork: All ductwork shall be sealed from time of manufacture, with seals intact upon delivery to construction site, and remain so, until ready for installation. Contractor is jointly responsible with HVAC subcontractor to ensure ducts are properly sealed and maintained.
 - a. Store ductwork in clean dry conditions and keep sealed while it is stored.
- B. Avoid use of virgin wood pallets whenever possible. It is preferable that pallets be manufactured from recycled wood and recycled plastic. Labeling of plastics used for packaging: Plastic is marked by manufacturers for type of plastic material in accordance with the Society of Plastic resin codes. Maintain marks, or sort by manufacturer's resin codes for recycling purposes.
1. Type 1: Polyethylene Terephthalate (PET, PETE).
 2. Type 2: High Density Polyethylene (HDPE).
 3. Type 3: Vinyl (Polyvinyl Chloride or PVC).
 4. Type 4: Low Density Polyethylene (LDPE).
 5. Type 5: Polypropylene (PP).

July 11, 2018

- 6. Type 6: Polystyrene (PS).
 - 7. Type 7: Other. Use of this code indicates that the package in question is made with a resin other than the six listed above, or is made of more than one resin listed above, and used in a multi-layer combination.
- C. Schedule deliveries to avoid delays in installation of products, to minimize long-term storage, to prevent overcrowding of construction . Coordinate with installation to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft and other losses.
 - D. Promptly inspect shipments to assure that products comply with requirements, quantities are correct, and products are undamaged.
 - E. Provide equipment and personnel to handle and store products by methods to prevent soiling, disfigurement, or damage.

1.8 PRODUCT STORAGE AND PROTECTION REQUIREMENTS

- A. Store and protect products in accordance with manufacturer's instructions and as specified in individual specification sections.
 - 1. Provide all necessary equipment and personnel to store products by methods to prevent soiling, disfigurement and damage.
 - 2. Store and protect products with seals and labels intact and legible.
- B. For exterior storage of fabricated products, place on sloped supports, above ground.
- C. Provide off-site storage and protection when site does not permit on-site storage or protection.
 - 1. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to avoid condensation.
 - 2. Store sensitive products in weather-tight, climate controlled enclosures.
- D. Store loose granular materials on solid flat surfaces in a well-drained area; prevent mixing with foreign matter.
- E. Arrange storage of products to permit access for inspection. Periodically inspect to assure products are undamaged and are maintained under specified conditions.
- F. Store heavy materials in locations and in a manner that will not damage or disfigure existing, or new construction.

1.9 MOLD PROTECTION OF PRODUCTS PRIOR TO INSTALLATION

- A. General:
 - 1. Keep building materials dry to prevent the growth of mold and bacteria, including, but not limited to: gypsum wallboard, wood, porous insulation, paper, and fabric.
 - 2. Cover materials to prevent rain damage, and if resting on the ground, use spacers to allow air to circulate between the ground and the materials.

July 11, 2018

POPE'S TAVERN
ADDITION/RENOVATION
Halifax, Massachusetts

3. Thoroughly dry all water damaged materials within 24 hours from time of moisture damage. Materials that have been damp or wet for more than 24 hours shall not be incorporated into the Work.
 - a. Review moisture damaged materials for signs of mold and mildew, including any with moisture stains, from the site and properly dispose of them.
 - b. Replace water damaged and moldy materials with new, undamaged materials.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

End of Section

Section 01 73 00
EXECUTION

PART 1 - GENERAL

1.1 SUMMARY

- A. Examination of existing conditions and acceptance of conditions.
- B. Project preparation.
- C. Surveying and field engineering.
- D. Execution of the Work.
- E. Cleaning.
- F. Protecting installed work.

1.2 RELATED REQUIREMENTS

- A. Section 01 73 29 - CUTTING AND PATCHING: Administrative and procedure requirements for cutting and patching.
- B. Section 02 41 19 - SELECTIVE DEMOLITION: Demolition of selected portions of the building for new construction.

1.3 EXAMINATION OF AND ACCEPTANCE OF EXISTING CONDITIONS

- A. The Contractor, its subcontractors and Filed-Subcontractors shall inform themselves of existing conditions before submitting his bid, and shall be fully responsible for carrying out all work required to completely and properly execute the work of the Contract, regardless of the conditions encountered in the actual work. No claim for extra compensation or extension of time will be allowed on account of actual conditions inconsistent with those assumed, except those conditions described in the General Conditions.
- B. Prior to commencement of selective demolition work, inspect areas in which work will be performed. Photograph existing damage to structure surfaces, equipment, or to surrounding properties which could be misconstrued as damage resulting from selective demolition work; file with Architect prior to starting work.

1.4 SURVEYING AND FIELD ENGINEERING

- A. Employ a Land Surveyor or Professional Engineer registered in the Commonwealth of Massachusetts and acceptable to the Architect.
 - 1. Submit evidence of Surveyor's Errors and Omissions (E&O) Insurance coverage in the form of an Insurance Certificate.
- B. Submittals.
 - 1. Submit name, address, and telephone number of at least three proposed Land Surveyors and obtain Architect's acceptance before starting survey work.

2. On request, submit documentation verifying accuracy of survey work.
 3. Submit a copy of registered site drawing and certificate signed by the Land Surveyor, that the elevations and locations of the Work are in conformance with the Contract Documents.
- C. Examination.
1. Verify locations of survey control points prior to starting work.
 2. Promptly notify Architect/Engineer of any discrepancies discovered.
- D. Survey Reference Points.
1. Contractor shall locate and protect survey control and reference points.
 2. Control datum for survey is that established by Owner provided Survey.
 3. Protect survey control points prior to starting site work; preserve permanent reference points during construction.
 4. Promptly report to Architect/Engineer the loss or destruction of any reference point or relocation required because of changes in grades or other reasons.
 5. Replace dislocated survey control points based on original survey control. Make no changes without prior written notice to the Architect.
- E. Survey Requirements.
1. Provide field engineering services. Utilize recognized engineering survey practices.
 2. Prior to construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer and water service piping.
 - a. The existence and location of underground utilities and construction indicated on Drawings as existing are not guaranteed. Before beginning sitework, verify the existence and location of underground utilities and other construction.
 3. Establish a minimum of 2 permanent bench marks on site, referenced to established control points. Record locations, with horizontal and vertical data, on Project Record Documents.
 4. Establish elevations, lines and levels. Locate and lay out by instrumentation and similar appropriate means:
 - a. Site improvements including pavements; stakes for grading, fill and topsoil placement; utility locations, slopes, and invert elevations.
 - b. Grid or axis for structures.
 - c. Building foundation, column locations, and ground floor elevations.
 5. Periodically verify layouts by same means.
- F. Project Record Documents.
1. As-built survey, progress submissions: Surveyor shall develop an as-built survey for the work-in-place. Copies of survey shall be submitted along with request for payments for foundation work, site utilities and paving work.
 2. Surveyor's log: Maintain a complete and accurate surveyor's log of control and other surveys, as required by Owner and authorities having jurisdiction. Make this log available for reference.

3. Submit Final Property Survey and log under the provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS.

1.5 PROTECTION OF ADJACENT ELEMENTS

- A. Protect installed Work and provide special protection where called for in individual specification Sections.
- B. Protect existing facilities and adjacent properties from damage from construction and demolition operations. Provide temporary and removable protection for installed products and occupied areas.
- C. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials. Coordinate with requirements under individual specification sections.
- D. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.
- E. Protect all existing landscape areas [not indicated to be cleared]. Do not deface, injure, or destroy trees or other plant life. Do not remove or cut trees or other plant life, without authorization from the Owner. Do not attach any anchorages, ropes, cables or guys to any trees scheduled to remain.
 1. Prohibit traffic from landscaped areas.
- F. Protect non-owned vehicles, stored materials, site and structures from damage.
- G. Refer to respective Sections for other particular protection requirements.

1.6 PROTECTION OF INTERIOR CONCRETE SLABS

- A. No satisfactory chemical or cleaning procedure is available to remove petroleum stains from the concrete surface. Prevention is therefore essential for areas scheduled to receive concrete stains and sealers, specified under Division 3.
 1. All hydraulic powered equipment must be diapered to avoid staining of in-place concrete.
 2. No trade will park vehicles on the inside slab. If necessary to complete their scope of work, drop cloths will be placed under vehicles at all times.
 3. No pipe cutting machine will be used on the inside floor slabs.
 4. Steel will not be placed on interior slabs to avoid rust staining.

1.7 EXECUTION REQUIREMENTS FOR INSTALLATION, APPLICATION AND ERECTION

- A. Inspection of conditions: The Installer of each component shall inspect the substrate and conditions under which Work is performed. Do not proceed until unsatisfactory conditions have been corrected.
- B. Resource Efficiency of Materials:
 1. Use construction practices such as material reduction and dimensional planning that maximize efficient use of resources and materials.
 - a. Recheck measurements and dimensions, before starting installation.

2. Provide materials that utilize recycled content to maximum degree possible without being detrimental to product performance or indoor air quality.
 3. Where possible and feasible, provide for non-destructive removal and re-use of materials after their service life in this building.
- C. Manufacturer's instructions: Comply with manufacturer's installation instructions and recommendations, to the extent that they are more stringent than requirements in Contract Documents.
- D. Inspect material immediately upon delivery and again prior to installation Reject damaged and defective items.
- E. Install each component during weather conditions and project status that will ensure the best results. Isolate each part from incompatible material as necessary to prevent deterioration.
- F. Coordinate temporary enclosures with inspections and tests, to minimize uncovering completed construction for that purpose.
- G. Limiting exposures: Supervise operations to ensure that no part of construction, completed or in progress, is subject to harmful or deleterious exposure.
1. Such exposures include, but are not limited to the following:
 - a. Excessive static or dynamic loading.
 - b. Excessive internal or external pressures.
 - c. Excessive weathering.
 - d. Excessively high or low temperatures or humidity.
 - e. Air contamination or pollution.
 - f. Water or ice.
 - g. Chemicals or solvents.
 - h. Heavy traffic, soiling, staining and corrosion.
 - i. Rodent and insect infestation.
 - j. Unusual wear or other misuse.
 - k. Contact between incompatible materials.
 - l. Theft or vandalism.
- H. Provide attachment and connection devices and methods necessary for securing each construction element. Secure each construction element true to line and level. Allow for expansion and building movement.
- I. Visual effects: Provide uniform joint widths in exposed Work. Arrange joints to obtain the best effect. Refer questionable choices to the Architect for decision.
- J. Mounting heights: Where mounting heights are not indicated, review heights with Architect, prior to commencement of Work.
- K. Cleaning and protection: During handling and installation, clean and protect construction in progress and adjoining materials in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.

- L. Clean and maintain completed construction as often as necessary through the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.
 - a. Individual filed sub-trades are responsible for designated types of coring and drilling penetrations for piping, conduit, ducts and other penetrations.

1.8 PROGRESS CLEANING AND DISPOSAL OF WASTE MATERIALS

- A. General: Maintain site in a clean and orderly condition. Maintain work and surrounding areas free of waste materials, debris, and rubbish; remove from site on a on-going basis through-out the term of construction.
 - 1. Adjacent Areas: Keep adjacent areas, neighboring properties, public ways, and all nearby areas clean and free of construction debris and dirt including wind blown debris.
 - 2. Filed Sub-bid Subcontractors are responsible for clean-up and removal of their own rubbish, debris, shipping materials and waste materials through-out the term of their work.
 - 3. General Contractor shall furnish dumpsters and provide general site cleaning services, except as explicitly specified otherwise under individual Sections of the Specifications.
- B. Control accumulation of waste materials and rubbish; periodically dispose of off-site. The General Contractor shall bear all costs, including fees resulting from such disposal.
- 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 site.
 - 2. Do not dispose of volatile wastes such as mineral spirits, oil, or paint thinner in storm or sanitary drains.
 - 3. Do not dispose of wastes into streams or waterways.
 - 4. Comply with requirements of authorities having jurisdiction including, without limitation, requirements related to fire prevention, rodents, pests, vermin, waste storage, waste trucking, waste removal, waste disposal, street cleaning, truck tire cleaning, and other requirements.
- D. Clean interior areas prior to start of finish work and maintain areas free of dust and other contaminants during finishing operations.
- E. Maintain project in accordance with all local, Commonwealth of Massachusetts, and Federal Regulatory Requirements.
- F. Store volatile wastes in covered metal containers, and remove from premises daily.
- G. Prevent accumulation of wastes which create hazardous conditions.
- H. Provide adequate ventilation during use of volatile or noxious substances.
 - 1. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.
 - 2. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.

July 11, 2018

- I. Use only those materials which will not create hazards to health or property and which will not damage surfaces.
- J. Use only those cleaning materials and methods recommended by manufacturer of surface material to be cleaned.
- K. Execute cleaning to ensure that the buildings, the sites, and adjacent properties are maintained free from accumulations of waste materials and rubbish and windblown debris, resulting from construction operations.
- L. Provide on-site containers (dumpsters) for collection and containment of, waste materials, debris and rubbish.
- M. General Contractor shall provide on-site containers (dumpsters) for collection and containment of, waste materials, debris and rubbish.
 - 1. Trash Barrels and Containers: Use containers with tightly fitting lids. Use only steel containers and lids when there is any evidence of rodent or pest activity.
 - 2. Returnables: Provide special, labeled containers for deposit returnables such as soda cans.
- N. Remove waste materials, debris, and rubbish from site at least once weekly, and dispose off-site. Comply with NFPA 241 for removal of combustible waste.
- O. Handle material in a controlled manner with as few handlings as possible. Do not drop or throw materials from heights.
- P. Schedule cleaning operations so that dust and other contaminants resulting from cleaning process will not damage surrounding surfaces.

1.9 SITE MAINTENANCE AND CLEANING

- A. Maintain traffic and parking areas in a sound condition, free of excavated material, construction equipment, products, mud, snow, and ice.
 - 1. Provide means of removing mud from vehicle wheels before entering public streets and Owner's parking areas and access.
- B. Maintain existing and permanent paved areas used for construction.
 - 1. If any street or private way shall be rendered unsafe by the Contractors operations, the Contractor shall make such repairs or provide such temporary ways or guards as shall be acceptable to the governing authority.
 - 2. Promptly repair breaks, potholes, low areas, standing water, and other deficiencies, to maintain paving and drainage in original, or specified, condition.

1.10 FINAL CLEANING

- A. Scheduling: Perform final cleaning immediately prior to the Architect's review of the project for issue of the Certificate of Substantial Completion.
 - 1. Re-clean all surfaces, materials and products of the Work immediately prior to Owner's occupancy of the Project.

- a. Should the Owner occupy any portion of the Work prior to completion of the Contract, the responsibilities for interim and final cleaning shall be in accordance with the General Conditions.
- B. Qualifications: Commercial cleaning firm, with a minimum of 3 years experience specializing in the post-construction cleaning of facilities.
- C. Protection: During the operation of final cleaning, protect surrounding materials and finishes against undue damage by the exercise of reasonable care and precautions. Clean, or repair all products and surfaces which are soiled or otherwise damaged by Work of this Section, to match original profiles and finishes. Materials and finishes which cannot be cleaned, or repaired shall be removed and replaced with new work in conformance with the Contract Documents.
- D. General cleaning requirements:
 1. Remove from the job site all tools, surplus materials, equipment, scrap, debris, and waste.
 2. Remove all advertising matter and temporary instructional material from exposed surfaces throughout.
 3. Use only methods and cleaning materials which are compatible with and as recommended by the manufacturer of the material being cleaned.
 4. Finished surfaces: Remove paint smears, spots, marks, dirt, mud and dust and similar disfigurement created by the Work, from all exposed to view existing or new interior and exterior finished surfaces.
 5. Polished surfaces: Apply the polish recommended by the manufacturer of the material being polished.
 6. Cleaning Materials: Only non-hazardous cleaning materials shall be used in the final cleanup.
- E. Exterior building surfaces:
 1. Visually inspect exterior surfaces and remove all traces of soil, waste materials, smudges, and other foreign matter.
 2. Remove all traces of splashed materials from adjacent surfaces.
 3. If necessary to achieve a uniform degree of cleanliness, hose down the exterior of the structure.
 4. In the event of stubborn stains not removable with water, the Architect may require light sandblasting or other cleaning at no additional cost to the Owner.
 5. Concrete: Clean exposed concrete free of all foreign matter. If, in the opinion of the Architect, further cleaning of specific areas is required, they shall be scrubbed with water or other cleaning agents. Acid cleaners shall not be used, except as may otherwise specifically permitted in the trade sections.
- F. Bright metal: Clean metal surfaces, hardware, fixtures, appliances, equipment, and similar items free of all foreign matter. As required, lightly scrub specific stains with clean water, mild soap, and soft rags, thoroughly rinsed and wiped with clean, soft white rags. Do not use abrasive cleaners.
- G. Glass: Replace broken, chipped and defective glass. Remove from glass: stains, spots, marks, paint smears; dirt and foreign materials. Clean and polish both surfaces of all interior and exterior glass. Clean and polish mirrors.

July 11, 2018

- H. Carpet: Vacuum clean carpet and remove all spots and stains.
- I. Hardware: Clean and polish finished hardware, remove marks, stains, scratches and blemishes.
- J. Tile: Clean and polish floor and wall tile, remove grout film and excess grout.
- K. Woodwork: Dust and clean architectural millwork, and finish woodwork items, remove all stains, spots, and foreign matter using methods and cleaning agents which will not harm the various finishes.
- L. Site: Sweep exterior paved surfaces broom clean; rake clean unpaved surfaces.
- M. Equipment: Thoroughly clean all items of mechanical and electrical equipment; remove excess oils and grease from exposed surfaces.
 - 1. Clean permanent filters and replace disposable filters if ventilating units were operated during construction.
 - 2. Clean ducts, blowers and coils, if units were operated without filters during construction.

1.11 PROTECTING INSTALLED WORK

- A. Protect all built, and in-place Work. In addition to requirements specified elsewhere, the Contractor shall protect all installed work from subsequent damage or deterioration from construction activities, and atmospheric damage until Owner's Substantial Completion and occupancy precludes the need for protection activities. No attempt is made in this Section to list all elements requiring protection or to describe how each element will be protected. It is the responsibility of the Contractor to determine for itself the scope and nature of protection required.
 - 1. Protection of some products/building elements may be required to remain in place for a large portion duration of the project. As such, materials should be installed to provide adequate protection throughout the full extent of construction activities. Repair or reinstall protection throughout the duration of construction as required.
- B. Finish Products: Some finishes may need to be physically isolated from construction operations by means of protective barriers and coverings.
 - 1. General: After installation, provide coverings to protect products from damage due to traffic and construction operations. Replace protective coverings which may become wet, torn, or ineffective. Remove coverings when no longer needed.
 - 2. Doors, door frames and hardware: Protect from damage due to traffic and construction operations.
 - 3. Floor and Finished Surfaces Protection: Protect against construction traffic, rolling loads, static loads, damage from material movement and storage, or similar causes of damage.
 - 4. Walls: Protect from impact, dents, marks, water damage, and similar damage.
 - 5. Glass: Protect from damage including etching and staining. Keep glass clean.
 - 6. Protect products sensitive to water damage from becoming wet.

7. Protect products sensitive to ultra-violet exposure and atmospheric exposure by limiting exposure to within limits recommended by respective product manufacturer.
 8. Protect products from biological growth, molds and mildew.
 9. Protect products from rodents and other animals, birds and insect damage.
- C. Roofing and waterproofing systems: Protect and isolate from traffic and construction operations. Protect from chemicals. Work and traffic directly upon roofing and waterproofing is prohibited, provide temporary walkways and platforms.
- D. General Protection from chemicals:
1. Cover adjacent surfaces with materials that are proven to resist chemical cleaners selected for Project unless chemicals being used will not damage adjacent surfaces. Use covering materials that contain only waterproof, UV-resistant adhesives. Apply masking agents to comply with manufacturer's written instructions. Do not apply liquid masking agent to painted or porous surfaces. When no longer needed, promptly remove masking to prevent adhesive staining.
 2. Do not clean surfaces during winds of sufficient force to spread cleaning solutions to unprotected surfaces.
 3. Neutralize and collect alkaline and acid wastes and dispose of off-site.
 4. Dispose of runoff from chemical operations by legal means and in a manner that prevents soil erosion, undermining of paving and foundations, damage to landscaping, and water penetration into building interiors.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

End of Section

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Section 01 73 29
CUTTING AND PATCHING

PART 1 - GENERAL

1.1 SUMMARY

- A. Examination of existing conditions and acceptance of conditions.
- B. Administrative and procedural requirements for cutting and patching, including attendant excavation and backfill as required to complete the Work. General Contractor is responsible for all cutting and patching work, including but not limited to:
 - 1. Perform all cutting, altering, patching, and fitting of the Work (new and existing) as necessary for the Work and the existing improvements. Fully integrate with existing and new construction, all cutting, alterations and patching, to present the visual appearance of an entire, completed, and unified project.
 - a. Make all products and their components of the work fit together properly.
 - 2. Provide openings in elements of the Work, and the patching of same, for penetrations required by all trades, including but not limited to mechanical, plumbing, fire protection and electrical work.
 - a. Individual Filed Subcontract trades are responsible for designated types of coring and drilling penetrations for piping, conduit, ducts and other penetrations as defined elsewhere in this Section.
 - 3. Uncover work to provide for installing, inspecting, or both, of ill-timed work;
 - 4. Remove and replace work not conforming to requirements of the Contract Documents or as otherwise determined to be defective.
 - 5. Patch and match all surfaces and products disturbed or damaged by the Work.
 - 6. Remove samples of installed work as specified for testing.

1.2 RELATED REQUIREMENTS

- A. Section 02 41 19 - SELECTIVE DEMOLITION: Demolition of selected portions of the building for new construction.
- B. Individual product specification Sections:
 - 1. Cutting and patching of not-exposed-to-view materials incidental to work of the Section.
 - 2. Core drilling (up to 8 inches in diameter) of interior building components, incidental to work of individual Sections.
 - 3. Cutting and Patching work of particular exposed-to-view finish work, performed by trades as specified herein.

1.3 SUBMITTALS

- A. Submit written proposals to perform cutting and patching under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES. Describe cutting and patching procedures in advance of the time cutting and patching.

1. Submit a written request when cutting work affects the following:
 - a. Structural integrity of any element in the project.
 - b. Integrity of weather-exposed or moisture-resistant elements.
 - c. Integrity of any fire suppression, fire alarm, or life safety system.
 - d. Interruption or disturbance of utilities service. List utilities that will be relocated and those that will be temporarily out-of-service. Indicate how long service will be disrupted.
 - e. Efficiency, maintenance, or safety of operational elements and systems.
 - f. Aesthetic and visual qualities of exposed-to-view elements.
 - g. Efficiency, operational life, maintenance, or safety of operational elements.
 - h. Work of Owner or work performed under separate Contract.
 - i. Owners on-going operations or schedule.
2. Include in the request:
 - a. Identification of project.
 - b. Location and description of affected work.
 - c. Necessity for cutting or alteration.
 - d. Alternatives to cutting and patching.
 - e. Scope of proposed cutting, patching, alteration or excavation.
 - f. List of tradespeople who will execute the work.
 - g. Description of products to be used.
 - h. Extent of refinishing and cleaning to be performed.
 - i. Effect on work by Owner or work performed under separate Contract, and written permission of affected party.
 - j. Date and time cutting and patching is scheduled to be executed.
 - k. Cost proposal, when applicable.
 - l. Written permission of separate contractor(s) whose work will be affected.
3. Review by the Architect does not waive the Architect's right to later require complete removal and replacement of Work found to be unsatisfactory.
4. Should conditions of Work or the schedule indicate a change of products from original installation, Contractor shall submit a request for substitution in accordance with Section 01 25 13 - PRODUCT SUBSTITUTION PROCEDURES.

1.4 QUALITY ASSURANCE

- A. Only tradespersons skilled and experienced in cutting and patching shall perform such Work.
- B. In performing Work which requires cutting, fixing, or patching, Contractor and subcontractors shall utilize best efforts to protect and preserve the visual appearance and aesthetics of the Project to the reasonable satisfaction of both Owner and Architect.

July 11, 2018

1.5 PERFORMANCE REQUIREMENTS

- A. General performance requirements: Execute work by methods to avoid damage to other Work, and which will provide appropriate surfaces to receive patching and finishing.
- B. Structural elements: Do not cut and patch structural elements in a manner that would reduce the load-carrying capacity or load deflection ratio. Always obtain written approval of the cutting and patching proposal before cutting and patching structural elements.
 - 1. Do not drill through structural beams, slabs or columns. Core drilling through concrete block walls and stair platforms must be approved by the Architect.
 - 2. Where cutting and patching involves adding reinforcement to structural elements, submit details and engineering calculations showing integration of reinforcement with the original structure.
- C. Exposed elements:
 - 1. Employ original installer of new construction to perform cutting and patching for weather exposed and moisture resistant elements, and sight exposed surfaces.
 - 2. Employ an appropriate tradesperson to perform cutting and patching of existing weather-exposed and moisture-resistant construction, and exposed-to-view surfaces.
- D. Penetrating elements: Fit work tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces. At penetrations of fire rated walls, partitions, ceiling or floor construction, completely seal voids with fire rated materials in accordance to applicable codes and regulations, and compatible to surrounding construction.
- E. Visual requirements: Do not cut and patch construction exposed on the exterior or in occupied spaces, in a manner that would, in the Architect's opinion, reduce the building's aesthetic qualities, or result in visual evidence of cutting and patching. Remove and replace Work cut and patched in a visually unsatisfactory manner.
 - 1. General: Restore work with new products in accordance with the requirements of the Contract Documents.
 - 2. Engage a firm recognized and experienced in the trade or specialty operation required to cut and patch the exposed-to-view work listed below.
 - a. Acoustical ceilings (Acoustical Ceilings Filed Subcontractor, refer to Section 09 51 00).
 - b. Carpeting.
 - c. HVAC enclosures, cabinets, or covers (Mechanical Filed Subcontractor, refer to Section 23 00 00).
 - 3. Engage a firm recognized and experienced in firestopping for patching of existing firestopping, smoke seals and firesafing in compliance with applicable codes and as additionally required by authorities having jurisdiction. Comply with requirements of Section 07 84 00 - FIRESTOPPING.
- F. Operational and safety limitations: Do not cut and patch operating elements or safety components in a manner that would reduce their capacity to perform as intended, or would increase maintenance, or decrease operational life or safety.

1. Obtain approval of the cutting and patching proposal before cutting and patching the following operating elements or safety related systems:
 - a. Primary operational systems and equipment.
 - b. Fire resistance rated barriers and smoke barriers.
 - c. Water, moisture, or vapor barriers.
 - d. Membranes and flashings.
 - e. Fire protection systems.
 - f. Noise and vibration control elements and systems.
 - g. Control systems.
 - h. Communication systems.
 - i. Electrical wiring systems.

1.6 WARRANTY

- A. Existing Warranties: Replace, patch, and repair material and surfaces cut or damaged by methods and with materials in such a manner as not to void existing applicable warranties.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Patching Materials: Use patching materials identical to existing materials. If identical materials are not available or cannot be used where exposed surfaces are involved, use materials that match existing adjacent surfaces to the fullest extent possible. Use materials whose installed performance will equal or surpass that of the existing materials. Comply with specifications and standards for each specific product involved.
 1. All materials used shall be approved by the Architect for consistency with the existing surfaces.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Pre-bid examination: General Contractor and Filed Subcontractors shall inform themselves of existing conditions before submitting bids, and are fully responsible for carrying out all work required to completely and properly execute the work of the Contract, regardless of the conditions encountered in the actual work. No claim for extra compensation or extension of time will be allowed on account of actual conditions which are inconsistent with those assumed, except for fully concealed conditions.
- B. Examination - General: Inspect existing conditions prior to commencing Work, including elements subject to damage or movement during cutting and patching. After uncovering existing work, inspect conditions affecting performance of work. Take corrective action before proceeding, if unsafe or unsatisfactory conditions are encountered.

3.2 PREPARATION

- A. Protection:
1. Provide temporary supports to ensure structural integrity of the Work.
 2. Protect existing construction during cutting and patching to prevent damage.
 3. Provide protection from adverse weather conditions.
 4. Provide protection from elements for areas which may be exposed by uncovering work.

3.3 GENERAL CUTTING AND PATCHING

- A. Performance: Execute work by methods to avoid damage to other Work, and which will provide appropriate surfaces to receive repairs, patching, and finishing.
- B. Execute cutting, fitting, and patching, including excavation and fill, to complete the work.
1. Cut rigid materials using masonry saw or core drill. Pneumatic tools are not permitted without prior approval, from Architect
 2. Fit products together, to integrate with other work.
 3. Uncover work to install ill-timed work.
 4. Remove and replace defective or non-conforming work.
 5. Remove samples of installed work for testing, when requested.
 6. Provide openings in the work for penetration of mechanical and electrical work.
- C. Cutting: Cut existing construction using methods least likely to damage elements retained or adjoining construction. Where possible, review proposed procedures with the original Installer; comply with the original Installer's recommendations.
1. In general, where cutting, use hand or small power tools designed for sawing or grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
 2. To avoid marring existing finished surfaces, cut or drill from the exposed or finished side into concealed surfaces.
 3. Cut through concrete and masonry using a cutting machine, such as a Carborundum saw or a diamond-core drill.
 4. Comply with requirements of applicable Division 31 - EARTHWORK Sections where cutting and patching requires excavating and backfilling.
 5. Where services are required to be removed, relocated, or abandoned, by-pass utility services, such as pipe or conduit, before cutting. Cut-off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal the remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after by-passing and cutting.

3.4 FINISHING OF PATCHED AREAS:

- A. General: Refinish surfaces to match adjacent finish. For continuous surfaces, refinish to nearest intersection or natural break; for assemblies, refinish entire unit.

July 11, 2018

1. Patching: Patch with durable seams that are as invisible as possible, showing no evidence of patching and refinishing. Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction Comply with specified tolerances.
 - a. At penetrations of fire rated walls, partitions, ceiling or floor construction, completely seal voids with fire rated materials in accordance to applicable codes and regulations, and compatible to surrounding construction.
 - b. Fit work tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces. Provide vapor and air seal when penetrating existing vapor and air seals.
 - c. Where feasible, inspect and test patched areas to demonstrate integrity of the installation.
2. Where removing walls or partitions extends one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform color and appearance. Remove existing floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
 - a. Where patching occurs in a painted surface, extend final paint coat over entire unbroken surface containing the patch after the area has received primer and second coat. Extend re-painting to entire surface plane up to where plane changes direction.
3. Patch, repair, or rehang existing ceilings as necessary to provide an even-plane surface of uniform appearance.

3.5 CORING AND DRILLING

- A. Coring and Drilling of holes incidental to work of individual sections shall be performed by the trade requiring the penetration, except as follows:
 1. Coring and Drilling of holes greater than 8 inches in diameter in concrete decks and slabs.
 2. The General Contractor is responsible for performing core drilling in wall and roof surfaces leading to, or from, the outside of the Building.
 3. The General Contractor is responsible for coordination of all coring and drilling and resultant patches necessary for the completion of this Contract and for the quality and appearance of all patch Work in exposed-to-view finished materials.

3.6 CLEANING

- A. Cleaning patched areas: Thoroughly clean areas and spaces where cutting and patching is performed or used as access. Remove paint, mortar, oils, putty and similar items.

End of Section

Section 01 75 00
STARTING AND ADJUSTING

PART 1 - GENERAL

1.1 SUMMARY

- A. Testing, adjusting, and balancing.
- B. Operation, maintenance, and service.

1.2 TESTING, ADJUSTING, AND BALANCING

- A. General: Adjust operating products and equipment to ensure smooth and unhindered operation.
 - 1. Contractor is advised that testing and balancing agents may be required during commissioning activities, or as may be additionally directed by Architect/Engineer.
- B. Filed-subcontractors under Division 21 – Fire Suppression, Division 22 – Plumbing and Division 23 – Heating, Ventilating and Air Conditioning are all responsible for primary system testing and balancing as specified under their respective Sections. General Contractor will be required to coordinate these services.
- C. The independent firm will perform services specified under Division 21 - Fire Suppression, Division 22 - Plumbing, and Division 23 - Heating, Ventilating, and Air Conditioning.
- D. Reports will be submitted by the independent firm to the Architect/Engineer indicating observations and results of tests and indicating compliance or non-compliance with specified requirements and with the requirements of the Contract Documents.

1.3 AIR QUALITY TESTING

- A. Air quality testing: The Owner reserves the right to employ the services of an independent testing agency to perform air quality testing. Testing will occur prior to Contractor's request for inspection for Substantial Completion. The intent of testing is to certify that the building is "Clear" of airborne contaminants.

1.4 OPERATION, MAINTENANCE, AND SERVICE

- A. Coordinate schedule for start-up of various equipment and systems.
- B. Notify Architect/Engineer and Owner 7 days prior to start-up of each item.
- C. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, or other conditions which may cause damage.
- D. Verify that tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.
- E. Verify wiring and support components for equipment are complete and tested.

July 11, 2018

POPE'S TAVERN
ADDITION/RENOVATION
Halifax, Massachusetts

- F. Execute start-up under supervision of responsible Contractors' personnel in accordance with manufacturers' instructions.
- G. When specified in individual specification Sections, require manufacturer to provide authorized representative to be present at site to inspect, check and approve equipment or system installation prior to start-up, and to supervise placing equipment or system in operation.
- H. Submit a written report in accordance with Section 01 77 00 - CLOSEOUT PROCEDURES that equipment or system has been properly installed and is functioning correctly.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

End of Section

Section 01 77 00
CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Closeout of incomplete work (punch list) requirements.
- B. Closeout procedures.
- C. Conferences occurring after Substantial Completion.

1.2 RELATED REQUIREMENTS

- A. Section 01 78 00 - CLOSEOUT SUBMITTALS: Requirements for project record documents.
- B. Section 01 78 36 - WARRANTIES: Administrative and procedural requirements for warranties, guarantees and bonds.

1.3 PUNCH LIST REQUIREMENTS AND PROCEDURES

- A. Definitions:
 - 1. Contractor's Punch List: Complete list of incomplete and incorrect Work prepared by the Contractor prior to request of Architect's inspection for Certification of Substantial Completion. As a minimum the List shall include the following information for each work item:
 - a. Location identification organized by Building, Area, Room Number, or combination thereof as appropriate to project.
 - b. Clear identification of each incomplete work item, including all subcontractor's work.
 - c. Estimated value of each incomplete work item.
 - d. A short statement of why work is not complete.
 - e. Identify subcontract responsibility, as appropriate to each item.
 - 2. Architect's Punch List: A list of incomplete and incorrect Work prepared by the Architect, which modifies the Contractor's Punch List, following review and acceptance of the Contractor's Punch List.
- B. Pre-Closeout requirements: Prior to requesting initial Architect's inspection for Certification of Substantial Completion, submit to the Architect a full and complete list of all incomplete work items (Contractor's Punch List).
- C. Punch list procedures at Substantial Completion:
 - 1. Architect will review submitted Contractor's Punch List and determine whether it is suitable to proceed with the Substantial Completion Process.
 - a. If the Architect determines that the amount of completed work is insufficient to be considered for Substantial Completion, the Architect will not proceed with the Punch List process until sufficient completion of the Project is achieved.

- b. The Architect will review the Contractor's Punch List and if the Architect determines that it does not reflect proper identification of the incomplete and incorrect work, he/she will request a revision and resubmission of the Contractor's Punch List.
 - c. If the Architect determines that the amount of work indicated on the Contractor's Punch List is excessive, the Architect will suspend its review until the scope of work identified in the Contractor's Punch List is reduced to a level satisfactory to the Architect.
 - d. When the Architect reviews and accepts the Contractor's Punch List as being an accurate reflection of incomplete and incorrect work; the Architect will prepare and issue to the Contractor the "Architect's Punch List".
 - 1) The "Architect's Punch List" will be based on the Contractor's Punch List with modifications and additions as may be required.
 - 2) The "Architect's Punch List" includes work which must be completed and corrected prior to final completion.
2. Upon receipt of the "Architect's Punch List", the Contractor shall immediately distribute the list to all subcontractors.
- D. Completion of Punch List Work: Make reasonable efforts to ensure that all "Architect's Punch List" items are completed or corrected within 14 calendar days from the date of the Architect's Punch List" or within the Contract Time, whichever comes first.
- E. Architect's Final Inspection and review of Punch List Work:
- 1. After Contractor certification that all Punch List Work has been properly completed the Architect will then perform the Final Inspection.
 - a. Incomplete Items: If the Architect discovers any incomplete or incorrect "Architect's Punch List" items or any other deficiency in the work, the Architect will prepare a "Revised Punch List" which may also include other incomplete Contract requirements such as record documents, owner's operation and maintenance manuals, warranties, and other Contract requirements. Architect's site reviews of the Work for this "Revised Punch List" and any subsequent revised Punch Lists shall be performed as additional service to Owner, back-charged to the Contractor.
 - b. The Architect may assign a dollar value for each item of incomplete or incorrect work remaining.
- F. Additional Inspections and related additional services fee: The Architect and the Architect's consultants will provide two site inspections, one at Substantial Completion, and one to confirm that the "Architect's Punch List" has been completed.
- 1. "Revised Punch List: If the Architect prepares and issues a "Revised Punch List: because of the Contractor's failure to complete the Work, then the Owner shall compensate the Architect and the Architect's consultants for their additional services and additional inspections. The payment for additional services and inspections will be back-charged to Contractor. The Owner will deduct the amount of the Architect's additional services fee from final payment to the Contractor by Change Order.

1.4 CLOSEOUT PROCEDURES - SUBSTANTIAL COMPLETION

- A. Prior to requesting inspection for certification of Substantial Completion, complete the following:
1. On Application for Payment, show 100 percent completion for portions of work claimed as substantially complete.
 - a. Submit list of incomplete items (Punch List), value of incomplete work, and reasons work is not complete.
 2. Obtain evidence of compliance with requirements of governmental agencies having jurisdiction including, but not necessarily limited to:
 - a. Certificate of Final Inspections, "signed off" by authorities having jurisdiction.
 - b. Certificate of Occupancy.
 3. Submission of product and installation warranties, workmanship bonds, maintenance agreements, installer certifications and similar documents specified in individual sections.
 4. Submission of test/adjust/balance reports.
 5. Change-over permanent locks and transmit keys to the Owner.
 6. Remove temporary facilities and services that are no longer required.
 7. Remove mock-ups, field samples and similar items.
 8. Complete final cleaning, including repair and restoration, or replacement of damaged Work.
 9. Remove surplus materials, rubbish and similar elements.
 10. Application for reduction of retainage.
 11. Consent of Surety.
 12. Advise the Owner of the change-over in security provisions.
 13. Notification of shifting insurance coverage.
 14. Final progress photographs.
- B. Within 2 weeks after receipt of the notice of Substantial Completion from the Contractor, the Architect will inspect to determine status of completion:
1. Should the Architect determine that the Work is not substantially complete:
 - a. The Architect will notify the Contractor in writing, stating the reasons therefore.
 - b. The Contractor shall remedy the deficiencies and send a second written notice of Substantial Completion to the Architect, requesting re-inspection.
- C. When the Architect concurs that the Work is substantially complete:
1. The Architect will prepare AIA Document G 704 - CERTIFICATE OF SUBSTANTIAL COMPLETION, in accordance with the requirements of the GENERAL CONDITIONS and SUPPLEMENTARY CONDITIONS, accompanied by the Contractor's list of items to be completed or corrected, as verified by the Architect.
 2. The Architect will submit the Certificate to the Owner, and to the Contractor, for their written acceptance of the responsibilities assigned to them in the Certificate.

1.5 CLOSEOUT PROCEDURES - FINAL ACCEPTANCE

- A. Prior to requesting inspection for certification of Final Acceptance and final payment, perform the following:
1. Completion of incomplete Work. Submit a copy of the final inspection list stating that each item has been completed or otherwise resolved for acceptance.
 2. Prove that all taxes, fees and similar legal obligations have been paid.
 3. Submit final payment requests with release of all liens, and supporting documentation.
 4. Provide written assurances that all unsettled claims are in the process of and will be resolved.
 5. Submit final meter readings for utilities, a record of stored fuel, and similar data, taken on date of Substantial Completion.
 6. Submit updated final statement, including accounting for final additional changes to the Contract Sum. Show additional Contract Sum, additions and deductions, previous Change Orders, total adjusted Contract Sum, previous payments and Contract Sum due.
 7. Submit consent of surety to Final Payment.
 8. Submit evidence of continuing insurance coverage complying with insurance requirements.
 9. Transmit certified property survey.
 10. Remove remaining temporary facilities and services.
 11. Deliver to Owner and obtain receipts for:
 - a. Operation and Maintenance Manuals for items so listed in individual Sections of the Specifications, and for other items when so directed by the Architect.
 - b. Project Record Documents (as-builts), including CAD format drawings.
 - c. Warranties and bonds specified in individual Sections of the Specifications.
 - d. Keys and keying schedule.
 - e. Spare parts and materials extra stock.
 - f. List of subcontractors, service organizations, and principal vendors, including names, addresses, and telephone numbers where they can be reached for emergency service at all times including nights weekends, and holidays.
 12. Submit Certification stating Work has been inspected for compliance with the Contract Documents.
 13. Submit Certification stating equipment and systems have been tested in presence of Owner's representative and are fully operational.
 14. Submit Certification stating that Work is 100 percent complete and ready for final inspection.
- B. Within 2 weeks after receipt of the request for Final Acceptance from the Contractor, the Architect will inspect to determine status of completion.
1. Should the Architect determine that the Work is incomplete or defective:

- a. The Architect will notify the Contractor in writing, stating the reasons listing the incomplete or defective work.
 - b. The Contractor shall take immediate steps to remedy the deficiencies and send a second written notice of request for Final Acceptance to the Architect.
 - c. Costs relative to the Architects re-inspection due to failure of Work to comply with claims made by the Contractor, will be compensated by the Owner, who will deduct the amount of such compensation from the Final Payment due to the Contractor.
- C. After the Architect finds the Work acceptable, the Architect will review the Final Close-out submittals.
- D. Application for Final Payment: Submit Application for Final Payment in accordance with procedures and requirements of the General Conditions and Supplementary Conditions.
- 1. The Architect will prepare a Final Change Order, reflecting approved adjustments to the Contract Sum not previously made by other Change Orders.
- 1.6 CONFERENCES AFTER SUBSTANTIAL COMPLETION

- A. The Owner reserves the right to call for conferences commencing with the date of Substantial Completion and continuing for one year thereafter, for purposes of inspecting the Work and to plan correction of any deficiencies or failures discovered during this period.
 - 1. Attendance is required by Contractor's Project Manager, Architect, Owner's Project Representative and each applicator, installer, and supplier as the Owner may direct or the Contractor may wish to have present. All representatives attending such meetings shall be the same persons, or shall have the same powers and authority, as those attending progress meetings occurring prior to the Date of Substantial Completion.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

End of Section

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Section 01 78 00
CLOSEOUT SUBMITTALS

PART 1 - GENERAL

1.1 SUMMARY

- A. Project record documents.
- B. Record Project Manual.
- C. Project Record Drawings (As built drawings).
- D. Final Site Survey.
- E. Emergency Manuals.
- F. Operation and maintenance data, preventive maintenance instructions.
- G. Materials and finishes manual.
- H. Maintenance contracts.
- I. Spare parts and maintenance materials.

1.2 RELATED REQUIREMENTS

- A. Section 01 31 00 - PROJECT MANAGEMENT AND COORDINATION:
 - 1. Coordination Drawing Requirements.
 - 2. Electronic file requirements for base sheets to prepare Project Record Drawings.
- B. Section 01 78 36 – WARRANTIES: Administrative and procedural requirements for warranties, guarantees and bonds.

1.3 PROJECT RECORD DOCUMENTS

- A. General: Record documents shall reflect actual “as-built” condition and the products installed. Include all changes and deviations from original Contract Documents, and incorporate information from:
 - 1. Original Contract Documents.
 - 2. Addenda.
 - 3. Change orders.
 - 4. Construction change directives.
 - 5. Field directives, and instructions from the Owner, Architect or regulatory authorities having jurisdiction.
- B. Project Record Documents include, but are not limited to:
 - 1. Record Project Manual.
 - 2. Project record drawings (as built drawings).
 - 3. Final Site Survey.

4. Operation and maintenance data, preventive maintenance instructions.
5. Materials and finishes manual.
6. Product warranties and bonds.
7. Maintenance contracts.
8. Record of all test reports and inspections.
9. Wall charts and data such as valve diagrams, electrical panel board directories, and similar information.

C. Labeling and identification of Record Documents

1. Clearly label all record documents with name of Project and the words "Record Document".
2. Date progressive entries of information as appropriate.
3. Date Record Documents with the final submission date.

1.4 SUBMITTAL QUANTITY REQUIREMENTS

A. Furnish Architect with the following quantities of each submittal:

1. Record Project Manual:
 - a. 1 electronic (PDF) copy.
2. Project record drawings (as-builts):
 - a. 1 set of Drawings in Autocad™ format. Verify release version and disc type with Owner prior to submittal.
 - b. 1 "blackline print" set of Drawings.
3. Final Site Survey:
 - a. 1 electronic (PDF) copy.
 - b. 1 "blackline print" set of Drawings.
4. Operation and maintenance data, preventive maintenance instructions:
 - a. 1 electronic (PDF) copy.
 - b. 3 bound hard copies (paper).
5. Materials and finishes manual:
 - a. 1 electronic (PDF) copy.
 - b. 3 bound hard copies (paper).
6. Product warranties and bonds:
 - a. 1 electronic (PDF) copy.
 - b. 3 bound hard copies (paper).
7. Maintenance contracts:
 - a. 1 electronic (PDF) copy.
 - b. 3 bound hard copies (paper).
8. Record of all test reports and inspections:
 - a. 1 electronic (PDF) copy.

1.5 RECORD PROJECT MANUAL

- A. The General Contractor is responsible to maintain a Project Manual reflecting revisions and changes to the Original Issue Project Manual.
 - 1. Clearly label the Record Project Manual as "Record Document Specifications, in a three ring binder.
 - 2. Do not use Record Project Manual for construction purposes; protect from loss in a secure location.
 - 3. Record all variations and deviations to the Contract Documents, including changes made by Addenda, Bulletin, Change Order, Change Directive and other modifications to the Contract.
 - a. Cut and paste revisions into their applicable specification section.
 - b. Identify all changes with cross-reference to appropriate Addendum Number, Modification Number, Change Order Number
 - 4. In each individual Specification Section, under "*Part 2 – Products*", identify all manufacturers and products which are actually used as part of the Work.
 - 5. Give particular attention to concealed elements that would be difficult to measure and record at a later date.
- B. Record Project Manual: Provide prior to request for Final Acceptance.
 - 1. Manuals shall be in 8-1/2 by 11 inch pages and bound in 3-ring (D-shape) binders with durable plastic covers. Internally subdivide the binder contents by Division with permanent page dividers.
 - 2. Label front cover and spine of each binder with laser printed titles, dates, and project information.
 - 3. All information from "in-progress" manual shall be clearly and completely transferred.
 - 4. Pages shall be undamaged.

1.6 PROJECT RECORD DRAWINGS

- A. The General Contractor is responsible to maintain a clean, undamaged set of blue or black line white-prints of Contract Drawings and shop drawings for preparing the record drawings.
 - 1. Where shop drawings are used, record a cross-reference at the corresponding location on the Contract Documents.
- B. Do not use Record Documents for construction purposes; protect from loss in a secure location. Mark-up these drawings to show clearly and completely the actual installation reflecting all changes made in the Work during construction.
 - 1. Mark whichever drawing is most capable of showing conditions accurately.
 - 2. Record all variations and deviations to the Contract Documents, including changes made to schedules, details, and all architectural changes to structure, exterior enclosure, interior partitions and ceilings.
 - 3. Record new information that is important to the Owner, but was not shown on the Contract Drawings or shop drawings.
 - 4. Give particular attention to concealed elements that would be difficult to measure and record at a later date.

July 11, 2018

- C. The fire protection, plumbing, mechanical and electrical trades shall be responsible to the Contractor to keep the record documents for their portions of the work marked currently to record all changes in the mechanical and electrical work made during construction.
- D. The Architect may periodically inspect these record drawings, and their proper maintenance may be a condition precedent to approval of applications for periodic payments.
- E. Deliver all Project Record Documents, shop drawings, product data, and samples to the Architect for the Owner's use, upon completion of the Work and prior to request for Final Acceptance of the Work.
- F. In addition at the completion of the work, the General Contractor is responsible for the preparation and submittal of neat, clean well drafted, and complete record drawings, at no additional costs to the Owner. These reproducible Project Record Documents shall be transmitted to the Architect as a condition precedent to final payment, and include documents prepared by the fire protection, plumbing, mechanical and electrical trades.

1.7 FINAL SITE SURVEY

- A. Under provisions of Section 01 73 00 - EXECUTION, Surveyor shall provide final corrected submission of Final Site Survey (As-built Property Survey) after work has been completed.
 - 1. Final site survey shall show significant features for the Project. Include a certification, signed by the Surveyor, to the effect that metes, bounds, lines and levels of the Project are accurately positioned as shown on the survey.
- B. Survey format shall be in accordance with requirements of the authorities having jurisdiction, and show the following as a minimum:
 - 1. Property boundaries.
 - 2. All required legal descriptions.
 - 3. Bench marks.
 - 4. Completed foundation work.
 - 5. Building extremities.
 - 6. Pad mounted equipment.
 - 7. All paving work.
 - 8. Easements and modifications to easements.
 - 9. Underground utilities and all changes in existing utilities.
- C. Record deviations from required lines and levels. Advise the Architect when deviations that exceed indicated or recognized tolerances are detected. On Final Site Survey, record deviations that are accepted and not corrected.
- D. Submit signed, sealed and certified copies shall be provided to the architect's office for review prior to filing with authorities having jurisdiction. Ensure information is complete, accurate submitted in a timely fashion.
 - 1. Recording: At Substantial Completion, have the final survey recorded by or with local authorities as the official "Property Survey".

1.8 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.

1.9 OPERATION AND MAINTENANCE MANUALS

- A. Prepare data in the form of an instructional manual. Furnish manuals which contain all of the following groups of equipment:
 - 1. Fire protection system.
 - 2. Utilities and plumbing systems.
 - 3. Heating, ventilation and air conditioning system.
 - 4. Electrical systems.

- B. Furnish bound and properly identified Manuals prior to request for Final Acceptance.
 - 1. Manuals shall be in 8-1/2 by 11 inch pages and bound in three "D ring" capacity binders with durable plastic covers. Internally subdivide the binder contents with permanent page dividers.

- a. Arrange content by section number and systems, process flow, under section numbers and sequence as listed in the Table of Contents of this Project Manual.
 - b. Drawings: Preferable 11 inches in height bound in with text with reinforced punched binder tab. Fold drawings larger than 8-1/2 by 11 inches to size of text pages. Provide a drawing pocket for Drawings larger than 11 by 17 inches; locate pocket inside rear cover or bound in with text.
2. Each manual shall include the same following minimum information:
- a. Table of Contents.
 - b. Directory of Contractor, subcontractors, and major equipment supplies listing addresses, phone numbers and appropriate emergency phone numbers.
 - 1) Include local sources of supplies and replacement parts.
 - c. Directory of Architect and consultants listing addresses and phone numbers.
 - d. Operation and maintenance instructions. Provide schematic diagrams of control systems, circuit directories for each electric panel and charts showing the tagging of all valves.
 - e. Air and water test and balancing reports.
 - f. Maintenance and cleaning instructions for finishes.
 - g. Product and manufacturer's Certificates.
 - h. Photocopies of all extended warranties and bonds.
3. Submit one copy of completed volume in final form 21 days prior to Final Inspection. This copy will be returned after final inspection with Architect's comments; Revise and submit all volumes to Owner.
- C. For each item of equipment, include description of equipment, component parts and accessories. Identify function, normal operating characteristics, and limiting conditions. Include performance curves, with engineering data and tests, and complete nomenclature and commercial number of replaceable parts. Additionally provide the following for each item:
1. Panel board circuit directories: Provide electrical service characteristics, controls and communications.
 2. Include color coded wiring diagrams as installed.
 3. Operating procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.
 4. Maintenance requirements: Include routine procedures and guide for troubleshooting; disassembly, repair, and re-assembly instructions; alignment, adjusting, balancing, and checking instructions.
 - a. Maintenance drawings: Supplement product data to illustrate relation of component parts of equipment and systems, to show control and flow diagrams. Do not use project Record Documents as maintenance drawings.
 5. Provide servicing and lubrication schedule, and list of lubricants required.

6. Include manufacturer's printed operation and maintenance instructions.
7. Include sequence of operation by controls manufacturer.
8. Provide control diagrams by controls manufacturer as installed.
9. Provide Contractor's coordination drawings, with color coded piping diagrams as installed.
10. Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.
11. Provide original manufacturer's parts (OEM) list, illustrations assembly drawings, and diagrams required for maintenance.
 - a. Provide list of original manufacturer's spare parts (OEM), current prices, and recommended quantities to be maintained in storage.
 - b. Include local source of supplies and replacement parts, and any other data pertinent for procurement procedures.
12. Additional requirements: As specified in individual specification Sections.

D. Standards:

1. Measurements: Provide all measurements in U.S. standard units such as feet and inches, pounds, and cfm; provide additional measurements in the "International System of Units" (SI).
2. Abbreviations: Provide complete nomenclature of all parts of all equipment; include part numbers of all replaceable parts.

1.10 MATERIALS AND FINISHES MANUAL

A. Furnish bound and properly identified manuals for all materials and finishes prior to request for Substantial Completion review.

1. Manuals shall be in 8-1/2 by 11 inch pages and bound in three "D ring" capacity binders with durable plastic covers. Internally subdivide the binder contents with permanent page dividers and logically organized.
2. Provide a listing in Table of Contents for design data, with tabbed fly sheet and space for insertion of data.
 - a. Arrange content by section number and systems, process flow, under section numbers and sequence as listed in the Table of Contents of this Project Manual.
 - b. Drawings: Preferable 11 inches in height bound in with text with reinforced punched binder tab. Fold drawings larger than 8-1/2 by 11 inches to size of text pages. Provide a drawing pocket for Drawings larger than 11 by 17 inches larger drawings; locate pocket inside rear cover or bound in with text.

B. Manuals shall include the following:

1. Product data, with catalog number, size, composition, and color and texture designations for all building products, applied materials, and finishes. Provide information for re-ordering custom manufactured products.
2. Instructions for care and maintenance: Include manufacturer's recommendations for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.

July 11, 2018

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Halifax, Massachusetts

3. Moisture protection and weather exposed products: Include product data listing applicable reference standards, chemical composition, and details of installation. Provide recommendations for inspections, maintenance, and repair.
4. Additional requirements: As specified in individual specification Sections.

1.11 SPARE PARTS AND MAINTENANCE MATERIALS

- A. Provide products, spare parts, maintenance and extra materials in quantities specified in individual specification Sections.
- B. Deliver materials to on-site location designated by the Owner; obtain receipt.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

End of Section

Section 01 78 36
WARRANTIES

PART 1 - GENERAL

1.1 SUMMARY

- A. General: This Section specifies general administrative and procedural requirements for warranties, guarantees and bonds required by the Contract Documents, including manufacturers standard warranties on products and special warranties. Warranty, Guarantee and Bond requirements of this Section are applicable to all trades, all Divisions of the Specifications, and applies to all Work performed under this Contract.
 - 1. Warranties required under the Contract are in addition to and not in lieu of any remedy or warranty to which the Owner is entitled under law.
 - 2. Warranties required under the Contract are not a waiver of Owner's legal rights.
- B. Contractor's Procurement Obligations: Do not purchase, subcontract for, or allow others to purchase or sub-subcontract for material or units of work for project where a special project warranty, certification or similar commitment is required, until it has been determined that entities required to countersign such commitments are willing to do so.

1.2 RELATED REQUIREMENTS

- A. General provisions of the Contract, including General and Supplementary Conditions apply to this Section.
- B. Section 01 78 00 – CLOSEOUT SUBMITTALS: Administrative and procedural requirements for submitting warranties.
- C. Individual Specification Sections contain additional specific requirements for warranties and bonds.
- D. Certifications and other commitments and agreements for continuing services to Owner are specified elsewhere in the Contract Documents.

1.3 DISCLAIMERS AND LIMITATIONS

- A. General Limitations: It is recognized that specific warranties are intended primarily to protect Owner against failure of the work to perform as required, and against deficient, defective, and faulty materials and workmanship, regardless of sources.
- B. Disclaimers and Limitations: Manufacturer's disclaimers and limitations on product warranties do not relieve the Contractor of the warranty on the work that incorporates the products, nor does it relieve suppliers, manufacturers, and subcontractors required to countersign special warranties with the Contractor .
 - 1. Pro-rating of warranties: Except where explicitly specified otherwise, each warranty issued shall cover the full cost of warranty-related repairs throughout the full term of the warranty.

July 11, 2018

1.4 DEFINITIONS

- A. Categories of Specific Warranties: Warranties on the work are in several categories, including those of General Conditions, and including (but not necessarily limited to) the following specific categories related to individual units of work specified in sections of Divisions 2 through 50 of these Specifications:
1. General Contractor's Comprehensive Warranty: The General Contractor shall provide a comprehensive one-year warranty covering all labor, materials, equipment and work related to the entire Contract, and shall promptly repair or replace defective and deficient work.
 2. Special Project Warranty (Guaranty): A warranty specifically written and signed by contractor for a defined portion of the work; and, where required, countersigned by subcontractor, installer, manufacturer or other entity engaged by Contractor. Special Warranties extend time limits provided by standard warranties or to provide greater rights for the Owner.
 3. Specified Product Warranty: A warranty which is required by Contract Documents, to be provided for a manufactured product incorporated into the work; regardless of whether manufacturer has published a similar warranty without regard for specific incorporation of product into the work, or has written and executed a special project warranty as a direct result of Contract Document requirements.
 - a. Standard Product Warranties are preprinted written warranties published by individual manufacturers for particular products and are specifically endorsed by the manufacturer to the Owner.
 4. Coincidental Product Warranty: A warranty not specifically required by Contract Documents (other than as specified in this Section), but which is available on a product incorporated into the work, by virtue of the fact that manufacturer or product has published warranty in connection with purchases and use of product without regard for specific applications except as otherwise limited by terms of warranty.

1.5 WARRANTY REQUIREMENTS

- A. Warranty Period Commencement Date: Effective starting date for Warranty periods is the Date of Substantial Completion for Project.
1. Equipment and systems start-up, operation and use, occurring prior to Project Substantial Completion, will not be considered commencement of warranty period under any terms of this Contract.
 2. Exceptions: Starting dates for warranties prior to the Project Date of Substantial Completion are not permitted, except for the two conditions below:
 - a. Warranty requirements specified in individual specification sections explicitly specify that a required warranty or guarantee shall be effective on date of shipment, date of manufacturer, or date of installation.
 - b. Warranties for Incomplete work: The effective date for warranty of work which has not been completed prior to the Date of Substantial Completion, shall be effective on the date of Final Completion and Owner's acceptance of the Work.
- B. Related Damages and Losses: In connection with Contractor's correction of warranted work which has failed, remove and replace other work of project which

has been damaged as a result of such failure, or must be removed and replaced to provide access for correction of warranted work.

1. Consequential Damages: Except as otherwise indicated or required by governing regulations, special project warranties and product warranties are not extended to cover damage to building contents (other than work of Contract) which occurs as a result of failure of warranted work.
- C. Reinstatement of Warranty Period: Except as otherwise indicated, when work covered by a special project warranty or product warranty has failed and has been corrected by replacement or restoration, reinstate warranty by written endorsement starting on date of acceptance of replaced or restored work.
1. Reinstated warranty value: The reinstated warranty shall be equal to the original warranty with an equitable adjustment for depreciation.
 2. Reinstated warranty period: A period of time ending upon date original warranty would have expired, if there had been no failure, but not less than half of original warranty period of time.
- D. Warranties are Irrevocable: Warranties issued to the Owner are irrevocable.
1. Non-Payment: If warrantor refuses to issue warranty, or attempts to revoke warranty due to lack of payment by any party other than the Owner, the Contractor shall resolve the payment conflict, and cause the warranty to be issued or reinstated.
 2. Incomplete or incorrect Installation: If warrantor refuses to issue warranty, or attempts to revoke warranty due to improper installation or other deficiency, the Contractor shall correct the deficiency and cause the warranty to be issued or reinstated.
- E. Transferable Warranties: All warranties shall permit Owner to transfer or assign warranties to future owners or other assignors at no additional cost to the Owner for the full warranty period.
- F. Replacement Cost: Upon determination that work covered by a warranty has failed, replace or rebuild the work to an acceptable condition complying with requirements of Contract Documents. The Contractor is responsible for the cost of replacing or rebuilding defective work regardless of whether the Owner has benefited from use of the work through a portion of its anticipated useful service life.
1. Work repairs or replaced under warranty shall be warranted for the full duration of the original warranty.
- G. Owner's Recourse: Written warranties made to the Owner are in addition to implied warranties, and shall not limit the duties, obligations, rights and remedies otherwise available under the law, nor shall warranty periods be interpreted as limitations on time in which the Owner can enforce such other duties, obligations, rights, or remedies.
- H. Rejection of Warranties:
1. Owner reserves the right, at time of substantial completion or thereafter, to reject coincidental product warranties submitted by Contractor, which in opinion of Owner tend to detract from or confuse interpretation of requirements of Contract Documents.

2. Owner reserves the right to reject warranties and to limit selection to products with warranties which are not in conflict with the requirements of the Contract Documents.
- I. Owner's right to refuse Work: The Owner reserves the right to refuse to accept work for the project where a special warranty, certification, or similar commitment is required on such work or part of the work, until evidence is presented that entities required to countersign such commitments are willing to do so.
- 1.6 COMPREHENSIVE WARRANTY
- A. Comprehensive Warranty: In addition to all other warranties, the General Contractor shall issue a Comprehensive Total Contract Warranty which shall include all work of this Contract, without limitation including consequential damages.
 1. Duration of Comprehensive Warranty: One full year from date of Substantial Completion.
 2. Consequential damages: Warranty includes consequential damages which relate to a warranty claim, these include without limitation:
 - a. All costs required to uncover and repair all work related to warranty claim.
 - b. All costs relating to repair and restoration of damaged property, resulting from warranty claim.
 - c. All costs resulting from failure to conform to the Contract Documents, and for required rebuilding, construction or reconstruction to correct work.
 - d. Perform to the satisfaction of the Owner all repairs, reconstruction, and restoration to original condition of adjacent and related work affected by damage under a warranty claim.
 - B. Warranty Claims: Owner will notify General Contractor in writing of each warranty claim. Warranty repairs shall be completed within 30 days of written notice, except as pre-approved by Owner.
 1. In the event of an emergency condition, where in the reasonable opinion of the Owner an immediate repair under warranty is necessary, warranty repairs shall be completed within 14 calendar days from date of notice.
 2. Owner's right to correct: In the event the Contractor fails to respond to a warranty claim within the specified time limits, the Owner reserves the right to make the necessary corrections or repairs and recover all costs and expenses from the General Contractor .
 - C. Contractor's responsibilities under Comprehensive Warranty:
 1. Notify in writing each affected warrantor and original Filed-Subcontractor, subcontractor, installer, vendor as appropriate to the warranty claim.
 2. Assist the Owner in obtaining warranty satisfaction.
 3. Arrange and manage all warranty related work including work relating to consequential damages.

July 11, 2018

1.7 SUBMITTALS

- A. Submit written warranties to the Owner prior to the date certified for Substantial Completion. In compliance with requirements specified under Section 01 77 00 – CLOSEOUT PROCEDURES and Section 01 78 00 – CLOSEOUT SUBMITTALS.
1. When a designated portion of the Work is completed and occupied, or used by the Owner by separate agreement with the Contractor during the construction period, submit properly executed warranties to the Owner within 14 calendar days of completion of the designated portion of Work.
 2. Refer to individual section of Divisions 2 through 50 for the determination of units of work which are required to be specifically or individually warranted, and for the specific requirements and terms of those warranties (or guarantees).
 3. Specific Warranty Forms: Where a special project warranty (guaranty) or specified product warranty is required to be executed, prepare a written document to contain terms and appropriate identification, ready for execution by all required parties (including manufacturers, vendors, and subcontractors). Submit draft to Owner (through Architect) for approval prior to final executions.
- B. Form of Submittal: At Final Completion, compile three (3) copies of each required warranty and bond properly executed by the General Contractor, or by the Filed-Subcontractor, subcontractor, supplier or manufacturer. Organize the warranty documents into an orderly sequence based on the Table of Contents of the Project Manual.
1. Bind warranties and bonds in heavy-duty, commercial quality, durable 3-ring vinyl-covered loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2" by 11" paper.
 2. Provide heavy paper dividers with celluloid-covered tabs for each separate warranty. Mark the 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 the installer.
 3. Identify each binder on the front and the spine with the typed or printed title "WARRANTIES AND BONDS", the project title or name, and the name of the General Contractor.
 4. When operating and manuals are required for warranted construction, provide additional copies of each required warranty, as necessary, for inclusion in each required manual.

PART 2 - PRODUCTS (Not Used)

PART 3 – EXECUTION

3.1 SCHEDULE

- A. Provide warranties on products and installations as specified in individual specification Sections in Divisions 2 through 50 of the Project Manual.

End of Section

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Section 01 79 00
DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 SUMMARY

- A. Demonstrating equipment.
- B. Instruction and training of Owner's personnel.

1.2 DEMONSTRATING EQUIPMENT

- A. Demonstrate operation and maintenance of Products to Owner's personnel 2 weeks prior to date of Substantial Completion.
- B. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.
- C. Utilize operation and maintenance manuals as basis for instruction. Review contents of manual with Owners' personnel in detail to explain all aspects of operation and maintenance.
- D. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shutdown of each item of equipment at agreed-upon times, at equipment location.
- E. Prepare and insert additional data in operations and maintenance manuals specified under Section 01 78 00 - CLOSEOUT SUBMITTALS when need for additional data becomes apparent during instruction.

1.3 INSTRUCTION AND TRAINING OF OWNER'S PERSONNEL

- A. Before final inspection, instruct Owner's designated personnel in operation, adjustment, and maintenance of products, equipment, and systems, at agreed upon times.
- B. For equipment requiring seasonal operation, perform instructions for other seasons within six months .
- C. Use operation and maintenance manuals as basis for instruction. Review contents of manual with personnel in detail to explain all aspects of operation and maintenance.
- D. Prepare and insert additional data in Operation and Maintenance Manual when need for such data becomes apparent during instruction.
- E. Provide sufficient formal instructional time for training Owner's personnel, so that the Owner's personnel will fully comprehend operation and maintenance of the facility's equipment and systems. Contractor's personnel designated for Owner training shall be competent and knowledgeable and have good communication skills.
 - 1. Training sessions shall be pre-arranged directly with the Owner.

- a. Instructors shall arrive at pre-scheduled training sessions on-time and be fully prepared to teach using a preplanned training program.
 - b. All instructors are subject to the Owner's approval. Replace unacceptable instructors and reschedule training as directed by the Owner at no increased cost to the Owner.
2. Training shall include the following:
- a. General overview of Record Documents:
 - 1) Record Drawings.
 - 2) Record Project Manual.
 - 3) Operation and Maintenance Manuals.
 - 4) Finishes.
 - 5) Warranty and maintenance agreements.
 - 6) Test reports and inspections.
 - b. Fire suppression systems and equipment.
 - c. Fire alarm systems and equipment.
 - d. HVAC systems and equipment.
 - e. Plumbing systems and equipment.
 - f. Electrical systems and equipment.
- F. Contractor's personnel designated for owner training shall be competent and knowledgeable and have good communication skills.
- 1. Instructors shall arrive at scheduled training sessions on-time and be fully prepared to teach using a preplanned training program.
 - 2. All instructors are subject to the Owner's approval. Replace unacceptable instructors and reschedule training as directed by the Owner at no increase cost to the Owner.
- G. Video Training Record: The Owner may, at its sole option, video record the instruction and training of the Owner's personnel. The Contractor and its subcontractors shall cooperate with the Owner.
- H. Final payment is condition precedent on completion of Owner training (instruction). Contractor is required to submit affidavit that training and instruction of Owner's personnel is completed.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

End of Section

Section 02 41 19
SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. The CONTRACT FORMS, and CONTRACT CONDITIONS as listed in the Table of Contents, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. General: The work described in this Section consists of selective demolition, cleaning, removal and legal disposal of all structures, equipment and materials indicated for demolition, or careful removal and temporary storage of materials and equipment indicated for salvage and re-use, or salvage and delivery to Owner. No attempt is made in this Section to list the entire scope of selective demolition required on this project or to describe each element to be removed. Drawings indicate both existing construction and final construction. It is the responsibility of the Contractor to determine for itself the scope and nature of the existing materials, equipment and finishes required for removal or salvage, based on the information provided in the full set of Contract Documents.
- B. Permits: Obtain and pay for all demolition and construction permits required by local authorities having jurisdiction and other regulatory agencies and utility companies.
- C. Selective demolition and removal work includes the following at indicated locations, but is not limited to:
 - 1. Remove concrete slabs where indicated.
 - 2. Remove existing lights, diffusers, grilles, speakers and similar equipment where scheduled to be replaced.
 - 3. Remove cabinetry, casework and similar items, where scheduled to be replaced.
 - 4. Remove designated exterior walls, interior partitions, ceiling and suspension systems, and flooring systems
 - 5. Remove designated doors, frames and associated hardware. Disconnect abandoned wiring and accessories for electrified hardware.
 - 6. Remove all furnishings, utilities, equipment and fixtures, not indicated for salvage or re-use, and abandoned materials of all kinds.
 - 7. Remove from site all abandoned, disconnected and dismantled fire protection, plumbing and mechanical equipment, including piping, conduits, system wiring, meters and other devices.
 - 8. Remove from site all abandoned, disconnected and dismantled electrical fixtures and equipment, including conduits, wiring, meters and other devices.

9. In addition to demolition specifically shown, cut, move or remove existing construction to remain as necessary to provide access or to allow alterations and new work to proceed. Coordinate such relocation's and removal to accommodate the demands and requirements of other trades.
 10. Removal of unsuitable or extraneous materials not marked for salvage, such as abandoned furnishings and equipment, and debris such as rotted wood, rusted metals and deteriorated concrete.
- D. Selective demolition and removal work by Filed Subcontractors includes, but is not limited to the following:
1. Each Filed Subcontractor shall Disconnect cut, cap and make safe all utilities, equipment and fixtures which are not indicated for salvage or re-use, or otherwise indicated to be abandoned in place as well as any abandoned materials of any kind.
 - a. Disconnect cut, cap and make safe, all utility services indicated to be demolished at their primary source. Obtain the approval from authorities having jurisdiction, or applicable service provider prior to the execution of the work.
 - b. Cut, cap and make safe all existing utility services indicated to be abandoned in place, where so indicated on the Drawings.
 2. Roofing and Flashing Filed Subcontractor shall remove existing roofing materials, roofing insulation, flashings and related materials.
 3. The Fire Protection Filed Subcontractor shall disconnect, detach and dismantle abandoned existing fire protection systems including, but not limited to piping, hangers, valves, and appurtenances.
 - a. Piping at slab will be disconnected by Fire Protection Filed Subcontractor.
 - b. Suspended hangers, piping, and appurtenances scheduled for demolition, shall be disconnected and lowered to floor by the Fire Protection Filed Subcontractor.
 4. The Plumbing Filed Subcontractor shall disconnect, detach and dismantle all existing abandoned plumbing systems and equipment including, but not limited to, fixtures, equipment, water heaters, piping, hangers, valves, insulation and appurtenances.
 - a. Piping at slab will be disconnected by Plumbing Contractor.
 - b. Suspended hangers, piping, equipment, fixtures and appurtenances scheduled for demolition, shall be disconnected and lowered to floor by the Plumbing Filed Subcontractor.
 5. The HVAC Filed Subcontractor shall disconnect, detach, dismantle all existing abandoned heating, ventilating, and air conditioning systems including, but not limited to, air handlers, air conditioners, pumps, cabinet unit heaters, unit heaters, radiation, exhaust fans, intakes, louvers, diffusers, grilles, and all related piping, ductwork, controls, and appurtenances.
 - a. Suspended hangers, equipment, ductwork and appurtenances scheduled for demolition, shall be disconnected and lowered to floor by HVAC Filed Subcontractor.
 6. The Electrical Filed Subcontractor shall disconnect, detach, dismantle all existing abandoned electrical systems and equipment including, but not

limited to, panelboards, light fixtures, fire alarm, intercom, speakers, wiring devices, and all related conduit and appurtenances.

- a. Suspended wiring, conduit, hangers, fixtures, equipment, and appurtenances scheduled for demolition, shall be disconnected and lowered to floor by the Electrical Filed Subcontractor.
 7. Remove, salvage and furnish to the General Contractor designated equipment, fixtures or other items so identified. Refer to notes on Drawings.
 8. Identify locations of utilities for work of other sections.
- E. Remove, salvage and provide storage for removed materials, equipment and furnishings indicated for re-use, including but not limited to:
1. NONE.
- F. Remove, salvage, and furnish to Owner for maintenance stock, or other future use, the following products. Carefully package and clearly identify prior to delivery to Owner.
1. Door hardware.
- G. Conduct walk-through of existing site prior to commencement of selective demolition work and jointly identify and tag with Owner items required to be salvaged. These products in general would be in addition to those indicated on Drawings.
1. All salvaged products not designated for re-use in project, shall be furnished to the Owner for its own use, carefully packaged and clearly identified.
- H. Identify locations of utilities for work of other sections.

1.3 RELATED REQUIREMENTS

- A. Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS: Procedural and administrative requirements for temporary facilities and controls.
- B. Section 01 73 29 - CUTTING AND PATCHING: Procedural and administrative requirements for cutting and patching.
- C. Division 21 - FIRE SUPPRESSION
1. Disconnection, salvage, re-working and re-installation of sprinkler system.
 2. Disconnection and dismantling designated fire suppression systems and components.
- D. Division 22 - PLUMBING
1. Disconnection, salvage, re-working and re-installation of plumbing system.
 2. Disconnection and dismantling designated plumbing systems and components.
- E. Division 23 - HEATING, VENTILATING AND AIR CONDITIONING (HVAC):
1. Disconnection, salvage, re-working and re-installation of roof-top ventilator ducts.
 2. Disconnection and dismantling designated mechanical systems and components.

July 11, 2018

- F. Division 26 - ELECTRICAL:
 - 1. Disconnection and dismantling designated electrical systems and components.
 - 2. Disconnection, salvage, and re-installation of designated light fixtures.
- G. Division 31 - EARTHWORK: Excavation and backfilling for foundations, ramps, below-grade utilities, retaining walls, and exterior concrete slabs.
- H. Individual specification sections: Cutting and patching incidental to work of individual specification sections shall be performed by respective trades, except as specified in Section 01 73 29 – CUTTING AND PATCHING.
- I. Individual specification sections: Utility shutoffs by respective trades.

1.4 REFERENCES

- A. Reference Standards: Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
 - 1. ANSI A10.6 – Safety Requirements for Demolition Operations.
 - 2. NFPA 241 – Standard for Safeguarding Construction, Alteration, and Demolition Operations.

1.5 OWNERSHIP OF REMOVED MATERIALS

- A. If during the work, articles of unusual value, or of historical or archaeological significance, are encountered the ownership of such articles is retained by the Owner, and information regarding their discovery shall be immediately furnished to the Architect. Resolution shall be handled as a Change in the Work.
- B. Ownership of materials, equipment and furnishings designated for salvage for re-use in this Project or designated for Owner's use is retained by the Owner.
- C. Ownership of materials, equipment and furnishings to be removed from the Project which are not defined by the above two paragraphs is retained by the Contractor; if any of these are considered of salvageable value to the Contractor, they may be removed from the Project as work progresses.
 - 1. On-site storage or sale of removed items is prohibited.

1.6 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Comply with all requirements of this contract relative to protection, scheduling and coordination with the Owner.
 - 2. Hazardous materials: When hazardous materials are encountered, they shall be handled, removed, and disposed of in accordance with all regulatory agency requirements.
 - 3. Coordinate and arrange with utility, mechanical and electrical trades for their disconnecting, rerouting and maintenance of existing services leading to adjacent occupied buildings, as part of the work of this Contract.

4. Coordinate Work of this Section with related utilities work identified in the Contract Documents.
- B. Sequencing:
1. Coordinate and arrange with mechanical and electrical trades for their disconnecting, rerouting and maintenance of existing services in the buildings as required, as part of the work of this Contract.
- C. Scheduling:
1. Comply with all requirements of this contract relative to protection, scheduling, phasing, and coordination with the Owner.

1.7 SUBMITTALS

- A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
1. Schedule: Prior to commencement of work, prepare a schedule indicating proposed methods and sequence of operations for demolition work.
 - a. Include coordination for shut-off, capping, and continuation of utility services as required, together with details for dust and noise control protection.
 - b. Provide detailed sequence of demolition and removal work to ensure uninterrupted progress of Owner's on-site operations. Receive acceptance from Architect prior to commencing work.
 2. Shop drawings: Indicate demolition sequencing and locations of salvageable items.
 3. Design Data: Submit calculations for bracing and shoring, signed and sealed by professional engineer registered in the Commonwealth of Massachusetts.
 4. Permits: Submit copy of permits required by regulatory agencies for demolition.
 5. Special Procedure Submittals: Submit copies of written agreements from private landowners, landfill operators, or other agencies accepting disposal of demolished materials at least two weeks prior to commencement of demolition work.

1.8 REGULATORY REQUIREMENTS

- A. Conform to applicable codes for demolition work, safety of structure, dust control, and disposal of debris. Conform to procedures applicable when discovering hazardous materials or contaminated substances.
- B. Obtain and pay for required permits and licenses required from authorities prior to commencing demolition work. Arrange and pay for legal disposal of removed materials and equipment, obtain proper disposal receipts for verification.
- C. Notify affected utility companies and Owner before starting work and comply with utility company requirements.
- D. Do not close or obstruct egress width to exits. Do not disable or disrupt building fire or life safety systems without 3 days prior written notification to the Owner.

July 11, 2018

1.9 QUALITY ASSURANCE

- A. General: Conduct the work in a manner giving prime consideration to protection of the public; protection from the weather, control of noise, shocks and vibration; control of dirt and dust; orderly access for and storage of materials; protection of existing buildings; protection of adjacent surfaces and property; coordination and cooperation with the Owner at all times.
 - 1. Comply with all requirements of this contract relative to protection, scheduling and coordination with the Owner.
- B. Qualifications:
 - 1. Demolition subcontractor: Company specializing in performing work of this section with minimum 3 years documented experience.
 - 2. Shoring and bracing design: Design shoring, and bracing, under direct supervision of Professional Engineer experienced in design of this Work and licensed at Project location.

1.10 SITE CONDITIONS

- A. Comply with wind and weather conditions established at pre-demolition meeting.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Condition of Structures: Owner assumes no responsibility nor makes any claim as to the actual condition or structural adequacy of any existing construction to be demolished. The Contractor shall investigate and assure himself of the condition of the work to be demolished and shall take all precautions to ensure safety of persons and property.
 - 1. Notify both Owner and Architect, if any type of hazardous chemicals, gases, explosives, flammable material, unmarked containers, or similar dangerous substances are discovered. Cease work in affected areas until directed by Architect. Continue work in other areas.
- B. The Contractor shall have examined the existing conditions per requirements of the Conditions of the Contract and Division 1 - General Requirements, and reviewed Contract Documents prior to commencement of demolition. Coordinate and verify scope of selective demolition with other portions of work specified in other sections, and under separate Contract. Change orders will not be issued for the removal of any exposed to view materials or equipment, which are either indicated on the Drawings for removal, or not indicated, but necessary to remove for the Work of this Project.

3.2 PREPARATION

- A. General: Provide necessary protection of non-work areas during demolition operations. Provide, erect and maintain temporary barriers as required to protect non-construction related pedestrian and vehicular traffic using the adjacent portions of the site and building.

1. Erect and maintain temporary partitions to prevent spread of dust, odors, and noise to permit continued Owner occupancy of adjacent facility.
- B. Protect existing structures which are not to be demolished. Protect designated materials and equipment to be removed and retained by Owner.
 1. Cover or otherwise protect as necessary existing equipment, furniture and furnishing located beyond the immediate demolition work.
 2. Protect existing landscaping materials, structures, and appurtenances which are not to be demolished.
- C. Prevent movement of structure; provide required bracing and shoring.
 1. Protect existing active utility services and structures from damage during selective demolition work including during installation of bracing and removal of same. Repair or replace damages to satisfaction of Owner.
- D. Dangerous Materials: Drain, purge, or otherwise remove, collect, and dispose of chemicals, gases, explosives, acids, flammables, or other dangerous materials before proceeding with demolition operations.

3.3 GENERAL REQUIREMENTS FOR SELECTIVE DEMOLITION

- A. Conduct demolition to minimize interference with adjacent building areas, in compliance with governing laws and buildings, with prime consideration given to the safety, protection and convenience of the public and Owner's personnel.
 1. Maintain protected egress and access to the Work at all times.
- B. Perform selective demolition in an orderly and careful manner. Carefully cut materials to be removed to eliminate damage to portions to remain. Protect existing structure designated to remain.
 1. Do not demolish building elements beyond what is indicated on Drawings without Architect's approval.
 2. Except as otherwise required by Project phasing requirements, proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
 3. Locate equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
 4. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent. Do not throw trash from windows or from roof.
 5. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
 6. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
 7. Pull nails and fasteners which remain after removal of attached material. Remove lath, strapping and other substructures associated with finishes to be removed.
 8. Where existing finishes are indicated to be removed, remove down to bare subsurface without causing damage to the subsurface.

- a. After removal of non-asbestos finish flooring materials, remove underlying mastic and prepare substrate to receive new flooring materials by Shot Blasting method. Create a uniform 20 mil profile. Mechanically scarify areas which cannot be profiled by shot blast method. Thoroughly wash all flooring substrate and leave clean and dry ready for application of new flooring materials.
- C. Remove foundation walls and footings as indicated on Drawings, and where indicated, to a minimum of two feet beyond area of new construction.
- D. Cutting openings and holes: Neatly cut openings and holes plumb, square, and true to dimensions required. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces.
 1. All penetrations in floors and roof shall be framed with miscellaneous metal work prior to cutting and demolition of deck and concrete.
 2. Repair damage done to existing elements of building to remain, except repairs specified to be provided under other Sections. Repairs shall be done in such manner as to closely match construction, appearance and quality of original work.
- E. Use of cutting torches:
 1. Do not use cutting torches until work area is cleared of flammable materials.
 2. Maintain adequate ventilation when using cutting torches.
 3. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations.
 4. Maintain fire watch and portable fire-suppression devices during flame-cutting operations. Comply with fire prevention measures specified under Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS.
- F. Carefully observe existing structure during demolition operations, cease operations immediately if structure appears to be in danger. Immediately notify both Architect and Owner's Project Representative. Do not resume demolition operations until directed.
- G. Disconnect, cap and clearly identify designated utilities within demolition areas.
 1. Cap and remove abandoned existing utilities back to locations indicated, or to limit line of Contract where terminations are not indicated.
 - a. Pipes to be demolished that require a connection shall be removed to the extent required to install the new connection. Remove pipe sections by saw-cutting, removing a complete pipe section to an existing joint, or other adequate means which results in a clean joint.
 2. Protect and maintain conduits, drains, sewers, pipes, and similar utilities that are not to be demolished
- H. Disconnect existing equipment and fixtures to be removed, or services abandoned, and piping, wiring, and conduit which would otherwise be exposed in the finished

work. Remove from site disconnected equipment and fixtures and piping not to be reused.

1. Contractor to remove and dispose of all equipment not tagged or scheduled for reuse.
- I. Abandoned Equipment, Utilities, Systems: Remove in their entirety. Abandonment in place is not acceptable, except where an item is specifically indicated to be abandoned in place.
 1. "Abandoned" means the item is not operational in the completed Contract.
 2. Without limitation, remove abandoned pipes, tubing, conduits, wires, cables, ducts, equipment, machines, and all elements and items related to abandoned work including, without limitation, hangers, connectors, anchors, valves, drains, strainers, sumps, panels, mounting boards, grounding rods, ground connectors, boxes, dampers, plenums, insulation, escutcheons, trims, and all other related items.
 3. Where an existing element is indicated to be abandoned in place, the abandoned item shall be cut off and, if hollow, capped.
 - a. Cut off sufficiently below the finished plane to permit space for patching over the abandoned element. The General Contractor shall provide all cutting and chipping required to recess the cut element, and to coordinate depth of cut-offs required for finishing.

3.4 BRACING

- A. Locate bracing to clear columns, floor framing construction, and other permanent work. If necessary to move a brace, install new bracing prior to removal of original brace. Provide suitable bracing materials which will support loads imposed
- B. Do not place bracing where it will be cast into or included in permanent concrete work, except as otherwise acceptable to Architect.
- C. Install internal bracing, if required, to prevent spreading or distortion to braced frames.
- D. Maintain bracing until structural elements are rebraced by other bracing or until permanent construction is able to withstand designed live and dead loads.
- E. Remove bracing in stages to avoid disturbance or damage to existing structure.
- F. Repair or replace adjacent work damaged or displaced through installation or removal of bracing work.

3.5 GENERAL DUST CONTROL

- A. Contractor shall employ dust and pollution prevention procedures at all times. Compliance with requirements for dust protection and air quality control is required for work areas which abut Owner occupied areas. Dust removal and periodic cleaning requirements apply to all work. Contractor shall employ dust and pollution prevention procedures so that a healthy Owner's environment is fully maintained at all times. Compliance with the requirements in Division One for dust control is mandatory and may not be compromised at any point during construction.

July 11, 2018

1. Clean up loose debris daily, or more frequently as required, to prevent the wind spreading debris. Keep dumpsters covered when not in use.
2. Cover handcars carrying debris being transported through Owner occupied areas.
3. Wet down debris (as appropriate) to prevent air pollution by dust rising from demolition work. Wet down dumpsters to prevent fires caused by vandals.
4. Employ tarpaulins on all trucks carrying debris.

3.6 SALVAGE MATERIALS AND PRODUCTS

- A. Carefully salvage and provide safe storage for products designated for salvage, reuse, as indicated on the Drawings, as specified herein, or as requested by Owner for reuse on the project, or to be stored for Owner's future use. Take particular care with finished items and items requiring special handling.
 1. Remove items indicated to be salvaged with extreme care to prevent damage.
 2. All components and parts of salvaged items shall be saved and packaged.
- B. Removed and Salvaged Items:
 1. Clean salvaged items.
 2. Pack or crate items after cleaning. Identify contents of containers.
 3. Store items in a secure area until delivery to Owner.
 4. Transport items to Owner's storage area as designated by Owner.
 5. Protect items from damage during transport and storage.
- C. Removed and Reinstalled Items:
 1. Clean and repair items to functional condition adequate for intended reuse. Paint equipment to match new equipment.
 2. Pack or crate items after cleaning and repairing. Identify contents of containers.
 3. Protect items from damage during transport and storage.
 4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.
- D. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

3.7 SPECIFIC DEMOLITION REQUIREMENTS FOR MATERIALS AND SURFACES.

- A. Floors, General:
 1. Completely remove existing flooring located in areas scheduled to receive new flooring surfaces and as additionally indicated. Remove all finish flooring layers of flooring down to the existing substrate.
 - a. Completely remove flooring systems to substrate, including full removal of all setting beds and adhesives.

- B. Walls, General:
 - 1. Remove interior walls and partitions as indicated and as needed to accommodate new work.
 - 2. Where existing walls-to-remain are indicated to receive new finishes, completely remove trim and fasteners.
- C. Ceilings, General:
 - 1. Where ceilings are indicated to be removed, also remove ceiling mounted systems and equipment leaving only bare structure free from hangers.
- D. Doors and Frames: Where doors and frames are indicated to be removed from walls or partitions which are to remain, remove doors and frames carefully so as to minimize damage to wall. Repair and patch wall as necessary to accommodate new door frame or other new work.
- E. Roofing: Roofing and Flashing Filed Subcontractor, specified under Section 07002, is responsible for demolition of roofing system components.
 - 1. Remove no more existing roofing than can be covered in one day by new roofing and so that building interior remains watertight and weathertight.
 - 2. Remove existing roof membrane, flashings, copings, and roof accessories.
 - 3. Remove existing roofing system down to substrate.
- F. Concrete, General: Demolish in small sections. Cut concrete to a depth of at least 3/4 inch (19 mm) at junctures with construction to remain, using power-driven saw. Dislodge concrete from reinforcement at perimeter of areas being demolished, cut reinforcement, and then remove remainder of concrete indicated for selective demolition. Neatly trim openings to dimensions indicated.
- G. Concrete Slabs (suspended and slabs-on-grade): Demolish in sections. Cut concrete full depth at junctures with construction to remain and at regular intervals, using power-driven saw, then remove concrete between saw cuts.
- H. Plumbing Equipment: Plumbing Filed Subcontractor specified under Section Division 22 is responsible to disconnect, cap and lower to floor items required to be removed, including but not limited to fixtures, equipment, water heaters, piping, hangers, valves, and insulation
- I. Heating, Ventilation, Air Conditioning, and Refrigeration (HVAC&R) Equipment:
 - 1. Drain system components designated for disposal of all lubricants, hydraulics, and refrigerants without releasing into atmosphere.
 - 2. HVAC&R Filed Subcontractor(s) specified under Division 23 is responsible to disconnect, cap and lower to floor items required to be removed, including but not limited to, ductwork, piping, fans, VAV boxes, unit ventilators, and all similar system equipment. General Contractor is responsible for removal from site and proper disposal.
- J. Electrical Equipment and Lighting Fixtures:
 - 1. Electrical Filed Subcontractor specified under Division 26 is responsible to disconnect, cap and lower to floor items required to be including but not limited to, panelboards, light fixtures, and overhead devices including, fire

alarm, intercom, bus ducts. General Contractor is responsible for removal from site.

3.8 REPAIRS

- A. Repair all damage done to elements of buildings and structures to remain, except repairs specified to be provided under other Sections, or as indicated for removal in subsequent project phase(s). Repairs shall be done in such manner as to closely match construction, appearance and quality of original work.

3.9 DISPOSAL OF DEMOLISHED MATERIALS

- A. General: Except for items or materials indicated or specified to be recycled, reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, remove demolished materials from Project site and legally dispose of them in an EPA-approved landfill.
 - 1. As work progresses, regularly remove demolished materials from site. Do not allow demolished materials to accumulate on-site, except as required for materials determined to be reused, salvaged, or as required to comply Commonwealth of Massachusetts regulations on specific banned materials prohibited from incineration or landfill disposal.
 - 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
 - 3. Liquid Waste Management: Dispose of liquid waste in accordance with all applicable regulations. Consult all regulations (federal, provincial, state, local) or a qualified waste disposal firm when characterizing waste for disposal. Contact manufacturer or MSDS sheets for product information, and recommendations for proposal disposal. Utilize licensed waste disposal companies as may be required.
- B. Do not burn or bury demolished materials on site, arrange for legal disposal of the same.
- C. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

3.10 CLEANING

- A. Daily cleaning: Sweep all street and roads affected by demolition operations.
- B. Upon completion of the work of this Section; remove unused tools and equipment, surplus materials, rubbish, debris, and dust. Leave area in raked or broom-clean condition, as appropriate.
- C. Upon completion of the work of this Section; clean adjacent structures and facilities of dust, dirt and debris caused by demolition work to the satisfaction of Owner, owner(s) of adjacent properties, and authorities having jurisdiction.

End of Section

Section 03 05 13
CONCRETE SEALERS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. The CONTRACT FORMS, and CONTRACT CONDITIONS as listed in the Table of Contents, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. Furnish and install concrete sealers/coatings on exposed-to-view concrete floors where shown and as scheduled on the Drawings.

1.3 RELATED REQUIREMENTS

- A. Section 03 30 00 - CAST-IN-PLACE CONCRETE:
 - 1. Placing and finishing concrete slabs.
 - 2. Dustproofing concrete slabs exposed to view and substrate for carpet.
- B. Section 09 05 60 - COMMON WORK RESULTS FOR FLOORING: General requirements for flooring preparation, substrate testing requirements, installation and temporary protection, for the work of this Section 03 05 13.

1.4 REFERENCES

- A. Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
 - 1. ASTM C156 – Water Retention by Liquid Membrane-Forming Curing Compounds for Concrete.
 - 2. ASTM C309 – Liquid Membrane-Forming Compounds for Curing Concrete.
 - 3. ASTM C1315 - Liquid Membrane-Forming Compounds, having Special Properties for Curing and Sealing Concrete

1.5 ADMINISTRATIVE REQUIREMENTS

- A. Pre-installation Meetings: Installer of the Work of this Section is required to attend pre-installation conference specified under Section 09 05 06 – COMMON WORK RESULTS FOR FLOORING.

1.6 SUBMITTALS

- A. Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:

1. Literature: Manufacturer's product data sheets, specifications, performance data, physical properties, material compositions, and application instructions for all finishing products to be applied hereunder.
 - a. Include certification of data indicating Volatile Organic Compound (VOC) content of all coatings.
2. Samples of each level of slip resistance, aggregate, and pattern available in the specified products from the proposed manufacturer.

1.7 QUALITY ASSURANCE

- A. Use an applicator approved by the manufacturer, experienced in the approved materials, and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

1.8 ENVIRONMENTAL CONDITIONS

- A. Work shall be done only under optimum conditions as recommended by manufacturer. Surfaces over which sealer is to be applied shall be completely dry (minimum 30 days since concrete placement) and thoroughly clean. Maximum moisture content is 8 percent. Substrate and ambient temperature shall be between 60 and 90 degrees Fahrenheit (15 to 32 degrees Celsius).

1.9 PRODUCT HANDLING

- A. Deliver materials to the job site and store in their original unopened containers with all labels intact and legible at time of use. Store in strict accordance with the manufacturer's recommendations.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Transparent non-yellowing water-based acrylic sealer having a minimum of 25 percent solids, with a maximum VOC limit of 100 g/L. Subject to compliance with ASTM C309, Type 1, Class A, ASTM C1315 Type 1, Class A, and requirements specified herein.
 1. Products which may be incorporated in the work include the following, or approved equal:
 - a. Laticrete International Inc., Bethany CT, (L&M Construction Chemicals Brand), Omaha NE, product "Dress & Seal WB25".
 - b. Dayton-Superior, Miamisburg OH, (Symons Brand), Des Plaines, IL, product "Cure & Seal 1315EF".
 - c. Nox-Crete Inc., Omaha NE, product "Cure & Seal 250E".

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verification of Conditions: Inspect all surfaces and verify that they are in proper condition to receive the work of this Section.

July 11, 2018

- B. Preinstallation Testing, Evaluation and Assessment: Moisture testing of concrete substrate, refer to Specification Section 09 05 60 – COMMON WORK RESULTS FOR FLOORING.

- 1. Beginning of installation means acceptance of existing substrate and site conditions.

3.2 SURFACE PREPARATION

- A. General: Comply with requirements specified under Section 09 05 60 – COMMON WORK RESULTS FOR FLOORING, the flooring manufacturer's requirements for preparation of substrate to receive resilient flooring, and as additionally specified herein.
- B. Upon acceptance of completed substrate surfaces, thoroughly remove all dust and debris by sweeping or vacuum cleaning.
- C. Remove laitance, curing sealers, existing adhesives and other foreign matter from concrete surfaces with necessary techniques such as shot blasting, Muriatic acid etching, surface freezing and power scarification.
- D. Surface preparation required if a curing compound has been applied to substrate surfaces.
 - 1. Thoroughly etch concrete surfaces using well mixed solution consisting of two parts by volume water diluted with one part by volume 30 percent commercial grade hydrochloric acid at a rate of one quart per ten square feet. Apply evenly to thoroughly saturated areas and scrub into surfaces using stiff-bristled broom. Allow solution to activate undisturbed for not less than five minutes or for duration of boiling effect.
 - 2. Thoroughly remove etching solution by washing down surfaces with clean water; flooded at least three separate times at a rate of two gallons per ten square feet; thoroughly remove all contaminants that may be engrained or latent in surfaces.
 - 3. Perform a test application of a square foot in three locations, such as beneath casework. Allow to set for 72 hours, and test adhesion as recommended by the manufacturer.

3.3 APPLICATION

- A. Apply sealer with manufacturer's recommended sprayer, at recommended rate of 400 square feet per gallon. Apply second coat when sealer is dry to touch. Allow sealer to cure undisturbed for a minimum period of 6 hours. Maintain temperature at 60 degrees Fahrenheit minimum until floor surfacing has completely dry.

3.4 CLEANING

- A. General: Comply with requirements of Section 01 73 00 – EXECUTION for periodic and final cleaning, and as additionally specified herein.
 - 1. Control accumulation of waste materials and trash. Daily clean work areas by sweeping and disposing of debris, and scraps.

End of Section

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SECTION 03 30 00
CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section specifies cast-in place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for the following:
 - 1. Footings.
 - 2. Foundation walls.
 - 3. Slabs-on-grade.
 - 4. Concrete toppings.
- B. Related Sections include the following:
 - 1. Division 03 Section "Architectural Concrete" for general building applications of specially finished formed concrete.
 - 2. Division 03 Section "Concrete Topping" for emery- and iron-aggregate concrete floor toppings.
 - 3. Division 31 Section "Earth Moving" for drainage fill under slabs-on-grade.
 - 4. Division 32 Section "Concrete Paving" for concrete pavement and walks.
 - 5. Division 32 Section "Decorative Concrete Paving" for decorative concrete pavement and walks.

1.3 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume; subject to compliance with requirements.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. LEED Submittals:
 - 1. Product Data for Credit MR 4.1 and Credit MR 4.2: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.

- a. Include statement indicating costs for each product having recycled content.
2. Design Mixtures for Credit ID 1.1: For each concrete mixture containing fly ash as a replacement for portland cement or other portland cement replacements and for equivalent concrete mixtures that do not contain portland cement replacements.
- C. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
 1. Indicate amounts of mixing water to be withheld for later addition at Project site.
- D. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.
- E. Formwork Shop Drawings: Prepared by or under the supervision of a qualified professional engineer detailing fabrication, assembly, and support of formwork.
 1. Shoring and Reshoring: Indicate proposed schedule and sequence of stripping formwork, shoring removal, and installing and removing reshoring.
- F. Qualification Data: For manufacturer.
- G. Material Test Reports: For the following, from a qualified testing agency, indicating compliance with requirements:
 1. Aggregates. Include service record data indicating absence of deleterious expansion of concrete due to alkali aggregate reactivity.
- H. Material Certificates: For each of the following, signed by manufacturers:
 1. Cementitious materials.
 2. Admixtures.
 3. Form materials and form-release agents.
 4. Steel reinforcement and accessories.
 5. Fiber reinforcement.
 6. Waterstops.
 7. Curing compounds.
 8. Floor and slab treatments.
 9. Bonding agents.
 10. Adhesives.
 11. Vapor retarders.
 12. Semirigid joint filler.
 13. Joint-filler strips.
 14. Repair materials.
- I. Floor surface flatness and levelness measurements to determine compliance with specified tolerances.
- J. Field quality-control test and inspection reports.

July 11, 2018

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.
- B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.
 - 1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."
- C. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated, as documented according to ASTM E 548.
 - 1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-01 or an equivalent certification program.
 - 2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician - Grade I. Testing Agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician - Grade II.
- D. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from one source, and obtain admixtures through one source from a single manufacturer.
- E. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
 - 1. ACI 301, "Specification for Structural Concrete," Sections 1 through 5.]
 - 2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."
- F. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.
 - 1. Review special inspection and testing and inspecting agency procedures for field quality control, concrete finishes and finishing, cold- and hot-weather concreting procedures, curing procedures, construction contraction and isolation joints, and joint-filler strips, semirigid joint fillers, forms and form removal limitations, vapor-retarder installation, anchor rod and anchorage device installation tolerances, steel reinforcement installation, floor and slab flatness and levelness measurement, concrete repair procedures, and concrete protection.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.
- B. Waterstops: Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

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 FORM-FACING MATERIALS

- A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
1. Plywood, metal, or other approved panel materials.
 2. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:
 - a. High-density overlay, Class 1 or better.
 - b. Medium-density overlay, Class 1 or better; mill-release agent treated and edge sealed.
 - c. Structural 1, B-B or better; mill oiled and edge sealed.
 - d. B-B (Concrete Form), Class 1 or better; mill oiled and edge sealed.
- B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.
- C. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that will produce surfaces with gradual or abrupt irregularities not exceeding specified formwork surface class. Provide units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.
- D. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch , minimum.
- E. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.
- F. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.
1. Formulate form-release agent with rust inhibitor for steel form-facing materials.

- G. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
 - 1. Furnish units that will leave no corrodible metal closer than 1 inch (25 mm) to the plane of exposed concrete surface.
 - 2. Furnish ties that, when removed, will leave holes no larger than 1 inch (25 mm) in diameter in concrete surface.
 - 3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

2.3 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 , deformed.
- B. Low-Alloy-Steel Reinforcing Bars: ASTM A 706/A 706M, deformed.
- C. Epoxy-Coated Reinforcing Bars: ASTM A 615/A 615M, Grade 60 coated, with less than 2 percent damaged coating in each 12-inch bar length.
- D. Plain-Steel Wire: ASTM A 82, galvanized.
- E. Deformed-Steel Wire: ASTM A 496.
- F. Epoxy-Coated Wire: ASTM A 884/A 884M, Class A, Type 1 coated, steel wire, with less than 2 percent damaged coating in each 12-inch wire length.
- G. Plain-Steel Welded Wire Reinforcement: ASTM A 185, plain, fabricated from as-drawn steel wire into flat sheets.
- H. Deformed-Steel Welded Wire Reinforcement: ASTM A 497, flat sheet.
- I. Epoxy-Coated Welded Wire Reinforcement: ASTM A 884/A 884M, Class A coated, Type 1, steel.

2.4 REINFORCEMENT ACCESSORIES

- A. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60 , plain-steel bars, cut bars true to length with ends square and free of burrs.
- B. Epoxy-Coated Joint Dowel Bars: ASTM A 615/A 615M, Grade 60 , plain-steel bars, ASTM A 775/A 775M epoxy coated.
- C. Epoxy Repair Coating: Liquid, two-part, epoxy repair coating; compatible with epoxy coating on reinforcement and complying with ASTM A 775/A 775M.
- D. Zinc Repair Material: ASTM A 780, zinc-based solder, paint containing zinc dust, or sprayed zinc.
- E. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports

from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:

1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.
2. For epoxy-coated reinforcement, use epoxy-coated or other dielectric-polymer-coated wire bar supports.
3. For zinc-coated reinforcement, use galvanized wire or dielectric-polymer-coated wire bar supports.

2.5 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:

1. Portland Cement: ASTM C 150, Type I/II
 - a. Fly Ash: ASTM C 618, Class C.
 - b. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.

B. Silica Fume: ASTM C 1240, amorphous silica.

C. Normal-Weight Aggregates: ASTM C 33, coarse aggregate or better, graded. Provide aggregates from a single source, with documented service record data of at least 10 years' satisfactory service in similar applications and service conditions using similar aggregates and cementitious materials.

1. Maximum Coarse-Aggregate Size: 3/4 inch nominal.
2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

D. Water: ASTM C 94/C 94M and potable.

2.6 ADMIXTURES

A. Air-Entraining Admixture: ASTM C 260.

B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.

1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
2. Retarding Admixture: ASTM C 494/C 494M, Type B.
3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

C. Set-Accelerating Corrosion-Inhibiting Admixture: Commercially formulated, anodic inhibitor or mixed cathodic and anodic inhibitor; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete and complying with ASTM C 494/C 494M, Type C.

1. Products:

- a. Boral Material Technologies, Inc.; Boral BCN.
- b. Euclid Chemical Company (The); Eucon CIA.
- c. Grace Construction Products, W. R. Grace & Co.; DCI.
- d. Master Builders, Inc.; Rheocrete CNI.
- e. Sika Corporation; Sika CNI.

- D. Non-Set-Accelerating Corrosion-Inhibiting Admixture: Commercially formulated, non-set-accelerating, anodic inhibitor or mixed cathodic and anodic inhibitor; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete.

1. Products:

- a. Axim Concrete Technologies; Catexol 1000CI.
- b. Boral Material Technologies, Inc.; Boral BCN2.
- c. Cortec Corporation; MCI 2005NS.
- d. Grace Construction Products, W. R. Grace & Co.; DCI-S.
- e. Master Builders, Inc.; Rheocrete 222+.
- f. Sika Corporation; FerroGard-901.

2.7 WATERSTOPS

- A. Flexible Rubber Waterstops: CE CRD-C 513, with factory-installed metal eyelets, for embedding in concrete to prevent passage of fluids through joints. Factory fabricate corners, intersections, and directional changes.

1. Manufacturers:

- a. Greenstreak.
- b. Progress Unlimited, Inc.
- c. Williams Products, Inc.

2. Profile: Dumbbell with center bulb]

3. Dimensions: 6 inches by 3/8 inch thick , nontapered.

- B. Self-Expanding Rubber Strip Waterstops: Manufactured rectangular or trapezoidal strip, bentonite-free hydrophilic polymer modified chloroprene rubber, for adhesive bonding to concrete, 3/8 by 3/4 inch (10 by 19 mm).

1. Products:

- a. Deneef Construction Chemicals; Swellseal.
- b. Greenstreak; Hydrotite.
- c. Mitsubishi International Corporation; Adeka Ultra Seal.
- d. Progress Unlimited, Inc.; Superstop.

2.8 VAPOR RETARDERS

- A. Plastic Vapor Retarder: ASTM E 1745, Class A. Include manufacturer's recommended adhesive or pressure-sensitive tape.

1. Products:

- a. Fortifiber Corporation; Moistop Ultra A.
- b. Raven Industries Inc.; Vapor Block 15.
- c. Reef Industries, Inc.; Griffolyn Type-105.

- B. Plastic Vapor Retarder: ASTM E 1745, Class B. Include manufacturer's recommended adhesive or pressure-sensitive tape.

1. Products:

- a. Fortifiber Corporation; Moistop Ultra.
- b. Raven Industries Inc.; Vapor Block 10.
- c. Stego Industries, LLC; Stego Wrap, 15 mils.

- C. Granular Fill: Clean mixture of crushed stone or crushed or uncrushed gravel; ASTM D 448, Size 57, with 100 percent passing a 1-1/2-inch sieve and 0 to 5 percent passing a No. 8 sieve.

- D. Fine-Graded Granular Material: Clean mixture of crushed stone, crushed gravel, and manufactured or natural sand; ASTM D 448, Size 10, with 100 percent passing a 3/8-inch sieve, 10 to 30 percent passing a No. 100 sieve, and at least 5 percent passing No. 200 sieve; complying with deleterious substance limits of ASTM C 33 for fine aggregates.

2.9 FLOOR AND SLAB TREATMENTS

- A. Slip-Resistive Emery Aggregate Finish: Factory-graded, packaged, rustproof, nonglazing, abrasive, crushed emery aggregate containing not less than 50 percent aluminum oxide and not less than 20 percent ferric oxide; unaffected by freezing, moisture, and cleaning materials with 100 percent passing [3/8-inch (9.5-mm)] [No. 4 (4.75-mm)] [No. 8 (2.36-mm)] <Insert size or gradation> sieve.

1. [Available]Products:

- a. Anti-Hydro International, Inc.; Emery.
- b. Dayton Superior Corporation; Emery Non-Slip.
- c. Emeri-Crete, Inc.; Emeri-Topcrete.
- d. Lambert Corporation; EMAG-20.
- e. L&M Construction Chemicals, Inc.; Grip It.
- f. Metalcrete Industries; Metco Anti-Skid Aggregate.
- g. <Insert manufacturer's name; product name or designation.>

- B. Slip-Resistive Aluminum Granule Finish: Factory-graded, packaged, rustproof, nonglazing, abrasive aggregate of not less than 95 percent fused aluminum-oxide granules.

1. [Available]Products:

- a. Anti-Hydro International, Inc.; A-H Alox.
- b. L&M Construction Chemicals, Inc.; Grip It AO.
- c. Sonneborn, Div. of ChemRex; Frictex NS.
- d. <Insert manufacturer's name; product name or designation.>

- C. Emery Dry-Shake Floor Hardener: [Pigmented] [Unpigmented], factory-packaged, dry combination of portland cement, graded emery aggregate, and plasticizing admixture; with emery aggregate consisting of no less than 60 percent of total aggregate content.
1. Color: [As indicated by manufacturer's designation] [Match Architect's sample] [As selected by Architect from manufacturer's full range].
- D. Metallic Dry-Shake Floor Hardener: [Pigmented] [Unpigmented], factory-packaged, dry combination of portland cement, graded metallic aggregate, rust inhibitors, and plasticizing admixture; with metallic aggregate consisting of no less than 65 percent of total aggregate content.
1. Color: [As indicated by manufacturer's designation] [Match Architect's sample] [As selected by Architect from manufacturer's full range].
- E. Unpigmented Mineral Dry-Shake Floor Hardener: Factory-packaged dry combination of portland cement, graded quartz aggregate, and plasticizing admixture.
1. [Available]Products:
 - a. Burke by Edoco; NonMetallic Floor Hardener.
 - b. ChemMasters; Concolor.
 - c. Conspec Marketing & Manufacturing Co., Inc., a Dayton Superior Company; Conshake 500.
 - d. Dayton Superior Corporation; Quartz Tuff.
 - e. Euclid Chemical Company (The); Surfex.
 - f. Kaufman Products, Inc.; Tycron.
 - g. Lambert Corporation; Colorhard.
 - h. L&M Construction Chemicals, Inc.; Quartzplate FF.
 - i. MBT Protection and Repair, Div. of ChemRex; Maximent.
 - j. Metalcrete Industries; Floor Quartz.
 - k. Scofield, L. M. Company; Lithochrome Color Hardener.
 - l. Symons Corporation, a Dayton Superior Company; Hard Top.
 - m. Vexcon Chemicals, Inc.; Durag Premium.
 - n. <Insert manufacturer's name; product name or designation.>
- F. Pigmented Mineral Dry-Shake Floor Hardener: Factory-packaged, dry combination of portland cement, graded quartz aggregate, color pigments, and plasticizing admixture. Use color pigments that are finely ground, nonfading mineral oxides interground with cement.
1. [Available]Products:
 - a. Burke by Edoco; NonMetallic Floor Hardener-Color.
 - b. ChemMasters; Concolor.
 - c. Conspec Marketing & Manufacturing Co., Inc., a Dayton Superior Company; Conshake 600 Colortone.
 - d. Dayton Superior Corporation; Quartz Tuff.
 - e. Euclid Chemical Company (The); Surfex.
 - f. Kaufman Products, Inc.; Tycron.
 - g. Lambert Corporation; Colorhard.
 - h. L&M Construction Chemicals, Inc.; Quartz Plate FF.
 - i. MBT Protection and Repair, Div. of ChemRex; Mastercron.
 - j. Metalcrete Industries; Floor Quartz.
 - k. Scofield, L. M. Company; Lithochrome Color Hardener.

- i. L&M Construction Chemicals, Inc.; L&M Cure R.
- j. Meadows, W. R., Inc.; 1100 Clear.
- k. Nox-Crete Products Group, Kinsman Corporation; Resin Cure E.
- l. Symons Corporation, a Dayton Superior Company; Resi-Chem Clear Cure.
- m. Tamms Industries, Inc.; Horncrete WB 30.
- n. Unitex; Hydro Cure 309.
- o. US Mix Products Company; US Spec Maxcure Resin Clear.
- p. Vexcon Chemicals, Inc.; Certi-Vex Enviocure 100.

2.11 RELATED MATERIALS

- A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber, or ASTM D 1752, cork or self-expanding cork.
- B. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.
- C. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements, and as follows:
 - 1. Types I and II, non-load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.
- D. Reglets: Fabricate reglets of not less than 0.0217-inch- thick, galvanized steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.
- E. Dovetail Anchor Slots: Hot-dip galvanized steel sheet, not less than 0.0336 inch thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.

2.12 REPAIR MATERIALS

- A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.
 - 1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
 - 2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
 - 3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by underlayment manufacturer.
 - 4. Compressive Strength: Not less than 4100 psi at 28 days when tested according to ASTM C 109/C 109M.

2.13 CONCRETE MIXTURES, GENERAL

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.

July 11, 2018

1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.
- B. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.
- C. Admixtures: Use admixtures according to manufacturer's written instructions.
 1. Use water-reducing, high-range water-reducing, or plasticizing admixture in concrete, as required, for placement and workability.
 2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
 3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.
 4. Use corrosion-inhibiting admixture in concrete mixtures where indicated.

2.14 CONCRETE MIXTURES FOR BUILDING ELEMENTS

- A. Footings: Proportion normal-weight concrete mixture as follows:
 1. Minimum Compressive Strength: 4000 psi at 28 days.
 2. Maximum Water-Cementitious Materials Ratio: 0.45.
 3. Slump Limit: 4 inches.
 4. Air Content: 6 percent, at point of delivery.
- B. Foundation Walls: Proportion normal-weight concrete mixture as follows:
 1. Minimum Compressive Strength: 4000 psi at 28 days.
 2. Maximum Water-Cementitious Materials Ratio: 0.45
 3. Slump Limit: 4 inches.
 4. Air Content: 6 percent. at point of delivery.
- C. Slabs-on-Grade, Slabs on Metal Deck: Proportion normal-weight concrete mixture as follows:
 1. Minimum Compressive Strength: 4000 psi at 28 days.
 2. Minimum Cementitious Materials Content: 520 lb/cu. yd.
 3. Slump Limit: 3 inches.
 4. Air Content: Do not allow air content of troweled finished floors to exceed 3 percent.
- D. Concrete Toppings: Proportion normal-weight concrete mixture as follows:
 1. Minimum Compressive Strength: 4000 psi at 28 days.
 2. Minimum Cementitious Materials Content: 520 lb/cu. yd.
 3. Slump Limit: 3 inches.
 4. Air Content: Do not allow air content of troweled finished toppings to exceed 3 percent.

2.15 FABRICATING REINFORCEMENT

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

2.16 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M and ASTM C 1116, and furnish batch ticket information.
 - 1. When air temperature is between 85 and 90 deg F , reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.
- B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Mix concrete materials in appropriate drum-type batch machine mixer.
 - 1. For mixer capacity of 1 cu. yd. or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.
 - 2. For mixer capacity larger than 1 cu. yd. , increase mixing time by 15 seconds for each additional 1 cu. yd.
 - 3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixture time, quantity, and amount of water added. Record approximate location of final deposit in structure.

PART 3 - EXECUTION

3.1 FORMWORK

- A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.
- B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.
- C. Limit concrete surface irregularities, designated by ACI 347R as abrupt or gradual, as follows:
 - 1. Class A, 1/8 inch for smooth-formed finished surfaces.
- D. Construct forms tight enough to prevent loss of concrete.
- E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
 - 1. Install keyways, reglets, recesses, and the like, for easy removal.
 - 2. Do not use rust-stained steel form-facing material.
- F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.
- G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.

July 11, 2018

- H. Do not chamfer exterior corners and edges of permanently exposed concrete, unless indicated on drawings.
- I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.
- J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
- K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
- L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 EMBEDDED ITEMS

- A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC's "Code of Standard Practice for Steel Buildings and Bridges."
 - 2. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.
 - 3. Install dovetail anchor slots in concrete structures as indicated.

3.3 REMOVING AND REUSING FORMS

- A. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 24 hours after placing concrete, if concrete is hard enough to not be damaged by form-removal operations and curing and protection operations are maintained.
 - 1. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.
- B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.
- C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

3.4 SHORES

- A. Comply with ACI 318 and ACI 301 for design, installation, and removal of shoring and bracing.

3.5 VAPOR RETARDERS

- A. Plastic Vapor Retarders: Place, protect, and repair vapor retarders according to ASTM E 1643 and manufacturer's written instructions.
 - 1. Lap joints 6 inches and seal with manufacturer's recommended tape.
- B. Bituminous Vapor Retarders: Place, protect, and repair vapor retarders according to manufacturer's written instructions.
- C. Granular Course: Cover vapor retarder with granular fill, moisten, and compact with mechanical equipment to elevation tolerances of plus 0 inch or minus 3/4 inch.
 - 1. Place and compact a 1/2-inch- thick layer of fine-graded granular material over granular fill.

3.6 STEEL REINFORCEMENT

- A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.
 - 1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.
- C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.
 - 1. Weld reinforcing bars according to AWS D1.4, where indicated.
- D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
- E. Install welded wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.
- F. Epoxy-Coated Reinforcement: Repair cut and damaged epoxy coatings with epoxy repair coating according to ASTM D 3963/D 3963M. Use epoxy-coated steel wire ties to fasten epoxy-coated steel reinforcement.

3.7 JOINTS

- A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.
- B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect. Maximum spacing of Construction joints in slabs and walls shall be 60 feet or 3600 square feet.

July 11, 2018

- C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas with as indicated, or a maximum 20 feet or 400 square feet. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:
 - 1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
 - 2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.

- D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
 - 1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface, unless otherwise indicated.
 - 2. Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface where joint sealants, specified in Division 07 Section "Joint Sealants," are indicated.
 - 3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

- E. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.

3.8 WATERSTOPS

- A. Flexible Waterstops: Install in construction joints and at other joints indicated to form a continuous diaphragm. Install in longest lengths practicable. Support and protect exposed waterstops during progress of the Work. Field fabricate joints in waterstops according to manufacturer's written instructions.

- B. Self-Expanding Strip Waterstops: Install in construction joints and at other locations indicated, according to manufacturer's written instructions, adhesive bonding, mechanically fastening, and firmly pressing into place. Install in longest lengths practicable.

3.9 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.

- B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect.

- C. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.
 - 1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

- D. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.
1. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.
 2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
 3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.
- E. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
 2. Maintain reinforcement in position on chairs during concrete placement.
 3. Screed slab surfaces with a straightedge and strike off to correct elevations.
 4. Slope surfaces uniformly to drains where required.
 5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.
- F. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
1. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
 2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
 3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.
- G. Hot-Weather Placement: Comply with ACI 301 and as follows:
1. Maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
 2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.
- H. 1. At slabs on composite metal deck, provide for additional concrete required beyond the design deck thickness to account for deflection of composite steel beams. Minimum 15%.

July 11, 2018

3.10 FINISHING FORMED SURFACES

- A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
 - 1. Apply to concrete surfaces not exposed to public view.
- B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
 - 1. Apply to concrete surfaces exposed to public view.
- C. Rubbed Finish: Apply the following to smooth-formed finished as-cast concrete where indicated:
 - 1. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.
 - 2. Grout-Cleaned Finish: Wet concrete surfaces and apply grout of a consistency of thick paint to coat surfaces and fill small holes. Mix one part portland cement to one and one-half parts fine sand with a 1:1 mixture of bonding admixture and water. Add white portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces. Scrub grout into voids and remove excess grout. When grout whitens, rub surface with clean burlap and keep surface damp by fog spray for at least 36 hours.
 - 3. Cork-Floated Finish: Wet concrete surfaces and apply a stiff grout. Mix one part portland cement and one part fine sand with a 1:1 mixture of bonding agent and water. Add white portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces. Compress grout into voids by grinding surface. In a swirling motion, finish surface with a cork float.
- D. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

3.11 FINISHING FLOORS AND SLABS

- A. General: Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes to produce a profile amplitude of 1/4 inch in 1 direction.
 - 1. Apply scratch finish to surfaces where indicated, to receive concrete floor toppings, to receive mortar setting beds, or for bonded cementitious floor finishes.

July 11, 2018

- C. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture.
1. Apply float finish to surfaces where indicated to receive trowel finish, and to be covered with fluid-applied or sheet waterproofing or built-up or membrane.
- D. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
1. Apply a trowel finish to surfaces where indicated, exposed to view, or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.
 2. Finish surfaces to the following tolerances, according to ASTM E 1155 , for a randomly trafficked floor surface:
 - a. Specified overall values of flatness, F(F) 35; and of levelness, F(L) 25; with minimum local values of flatness, F(F) 24; and of levelness, F(L) 17; for slabs-on-grade.
 3. Finish and measure surface so gap at any point between concrete surface and an unveled, freestanding, 10-foot- long straightedge resting on 2 high spots and placed anywhere on the surface does not exceed 1/8 inch.
- E. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces as indicated, where ceramic or quarry tile is to be installed by either thickset or thin-set method. While concrete is still plastic, slightly scarify surface with a fine broom.
1. Comply with flatness and levelness tolerances for trowel finished floor surfaces.
- F. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, and ramps, and elsewhere as indicated.
1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.
- G. Slip-Resistive Finish: Before final floating, apply slip-resistive aggregate, aluminum granule finish where indicated and to concrete stair treads, platforms, and ramps. Apply according to manufacturer's written instructions and as follows:
1. Uniformly spread 25 lb/100 sq. ft. of dampened slip-resistive aggregate over surface in 1 or 2 applications. Tamp aggregate flush with surface, but do not force below surface.
 2. After broadcasting and tamping, apply float finish.
 3. After curing, lightly work surface with a steel wire brush or an abrasive stone and water to expose slip-resistive aggregate.

3.12 MISCELLANEOUS CONCRETE ITEMS

- A. Filling In: Fill in holes and openings left in concrete structures, unless otherwise indicated, after work of other trades is in place. Mix, place, and cure concrete, as specified, to blend with in-

July 11, 2018

place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.

- B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.
- C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on Drawings. Set anchor bolts for machines and equipment at correct elevations, complying with diagrams or templates from manufacturer furnishing machines and equipment.
- D. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items. Cast-in inserts and accessories as shown on Drawings. Screed, tamp, and trowel-finish concrete surfaces.

3.13 CONCRETE PROTECTING AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.
- B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h (1 kg/sq. m x h) before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
- C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for the remainder of the curing period.
- D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.
- E. Cure concrete according to ACI 308.1, by one or a combination of the following methods:
 - 1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
 - a. Water.
 - b. Continuous water-fog spray.
 - c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
 - 2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
 - a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.

- b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
 - c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer certifies will not interfere with bonding of floor covering used on Project..
3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.
- a. After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer, unless manufacturer certifies curing compound will not interfere with bonding of floor covering used on Project.
4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.14 LIQUID FLOOR TREATMENTS

- A. Penetrating Liquid Floor Treatment: Prepare, apply, and finish penetrating liquid floor treatment according to manufacturer's written instructions.
- 1. Remove curing compounds, sealers, oil, dirt, laitance, and other contaminants and complete surface repairs.
 - 2. Do not apply to concrete that is less than 14 days' old.
 - 3. Apply liquid until surface is saturated, scrubbing into surface until a gel forms; rewet; and repeat brooming or scrubbing. Rinse with water; remove excess material until surface is dry. Apply a second coat in a similar manner if surface is rough or porous.
- B. Sealing Coat: Uniformly apply a continuous sealing coat of curing and sealing compound to hardened concrete by power spray or roller according to manufacturer's written instructions.

3.15 JOINT FILLING

- A. Prepare, clean, and install joint filler according to manufacturer's written instructions.
- 1. Defer joint filling until concrete has aged at least one month. Do not fill joints until construction traffic has permanently ceased.
- B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.
- C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches (50 mm) deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

July 11, 2018

3.16 CONCRETE SURFACE REPAIRS

- A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.
- B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part portland cement to two and one-half parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.
- C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
 - 1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension in solid concrete, but not less than 1 inch in depth. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
 - 2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
 - 3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.
- D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
 - 1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
 - 2. After concrete has cured at least 14 days, correct high areas by grinding.
 - 3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
 - 4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
 - 5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
 - 6. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete except without

- coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
7. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.
- E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.
 - F. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.17 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Owner will engage a special inspector and qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Testing and Inspecting: Engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.
- C. Inspections:
 1. Steel reinforcement placement, size spacing, and coverage.
 2. Embedded bolts and studs.
 3. Verification of use of required design mixture.
 4. Concrete placement, including conveying and depositing.
 5. Curing procedures and maintenance of curing temperature.
 6. Verification of concrete strength before removal of shores and forms from beams and slabs.
- D. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:
 1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd. but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.
 2. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
 3. Air Content: ASTM C 231, pressure method, for normal-weight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
 4. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.
 5. Unit Weight: ASTM C 567, fresh unit weight of structural concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
 6. Compression Test Specimens: ASTM C 31/C 31M.

- a. Cast and field cure sets of four standard cylinder specimens for each composite sample.
7. Compressive-Strength Tests: ASTM C 39/C 39M; test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days.
 - a. Test one set of two field-cured specimens at 7 days and one set of two specimens at 28 days.
 - b. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.
 8. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
 9. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
 10. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
 11. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
 12. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42/C 42M or by other methods as directed by Architect.
 13. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
 14. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.
- E. Measure floor and slab flatness and levelness according to ASTM E 1155 within 48 hours of finishing.

END OF SECTION 033000

Section 04 00 01
MASONRY FILED SUB-BID REQUIREMENTS
(FILED SUB-BID REQUIRED)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. The BIDDING REQUIREMENTS, CONTRACT FORMS, and CONTRACT CONDITIONS as listed in the Table of Contents, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Work of this Section requires Filed Sub-bids and is governed by the provisions of the Massachusetts General Laws (MGL), Public Bidding Law - Chapter 149, Sections 44A to 44J inclusive, as amended, and applicable Sections of the MGL, Public Contract Law - Chapter 30.
- C. Specification requirements for the Filed Sub-bid "MASONRY" include all of the following listed Specification Sections: in their entirety:
 - 1. Section 04 00 01 - Masonry Filed Sub-bid Requirements
 - 2. Section 04 01 29 - Restoration of Unit Masonry
 - 3. Section 04 20 00 – Reinforced Unit Masonry
 - 4. Section 04 22 00 – Concrete Unit Masonry
- D. The work to be completed by the Filed Subcontractor for the work of this Section is shown on the following listed Drawings, not just those pertaining particularly to this Sub-Trade, unless specifically called out otherwise, regardless of where among the Drawings it appears:
 - G-001 TITLE SHEET
 - G-002 CODE SUMMARY, NOTES & DRAWING LIST
 - AD-101 EXISTING & SELECTIVE REMOVAL PLANS
 - A-100 BASEMENT PLAN
 - A-101 FIRST FLOOR PLAN
 - A-102 SECOND FLOOR PLAN
 - A-201 EXTERIOR ELEVATIONS
 - A-202 EXTERIOR ELEVATIONS
 - A-301 BUILDING SECTIONS
 - A-402 ELEVATOR
 - A-403 ELEVATOR DETAILS
 - A-408 TYPICAL EXTERIOR STAIR DETAILS
 - A-701 PARTITION TYPES
 - A-702 DETAILS - EXTERIOR ENVELOPE
 - A-902 WINDOW SCHEDULES & DETAILS
 - S-1.0 STRUCTURAL FRAMING PLANS
 - S-2.0 TYPICAL STRUCTURAL DETAILS GENERAL NOTES
- E. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the Work of this Filed Subcontract.

1. Refer to Section 01 23 00 - ALTERNATES, for Bid alternates which may affect the scope of Work of this Section.
- F. Sub-Bids for work under this Section shall be for the complete work and shall be submitted electronically to the Awarding Authority at time and in manner stipulated in the INVITATION TO BID and INSTRUCTIONS TO BIDDERS.
 1. Each Sub-Bid submittal for work under this Section shall be accompanied with the required bid deposit.
- G. Sub Sub-Bid Requirements: NONE REQUIRED UNDER THIS SECTION.

1.2 EXAMINATION OF SITE AND DOCUMENTS

- A. 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 (Owner) will not be responsible for errors, omissions and/or charges for extra work arising from General Contractor's or Filed Subcontractor's failure to familiarize themselves with the Contract Documents or existing 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: Bidders are strongly encouraged to attend the Pre-Bid conference; refer to INVITATION TO BID for time and date.

1.3 SEQUENCING

- A. Coordinate work of this Filed Subcontract with that of other trades, affecting or affected by this work, and cooperate with the other trades as is necessary to assure the steady progress of work.
- B. Do not order or deliver any materials until all submittals, required in the listed Specification Sections included as part of this Filed Subcontract, have been received and approved by the Architect.
- C. Before proceeding with installation work, inspect all project conditions and all work of other trades to assure that all such conditions and work are suitable to satisfactorily receive the work of this Section and notify the Architect in writing of any which are not. Do not proceed further until corrective work has been completed or waived.

PART 2 - PRODUCTS

2.1 SCAFFOLDS AND STAGING

- A. General: Filed Subcontractors shall obtain required permits for, and provide scaffolds, staging, and other similar raised platforms, required to access their Work as specified in Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS and herein.
 1. Scaffolding and staging required for use by this Filed Subcontractor pursuant to requirements of Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS shall be furnished, erected, maintained in a safe condition, and dismantled when no longer required, by this Filed Sub-Trade requiring such scaffolding.

July 11, 2018

2. Each Filed Subcontractor is responsible to provide, maintain and remove at dismantling, all tarpaulins and similar protective measures necessary to cover scaffolding for inclement weather conditions other than those required to be provided, maintained and removed by the General Contractor pursuant to MGL (Refer to Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS and as additionally required for dust control).
3. Furnishing portable ladders and mobile platforms of all required heights, which may be necessary to perform the work of this trade, are the responsibility of this Filed Subcontractor.

2.2 HOISTING MACHINERY AND EQUIPMENT

- A. All hoisting equipment, rigging equipment, crane services and lift machinery required for the work by this Filed Subcontractor shall be furnished, installed, operated and maintained in safe conditions by this Filed Subcontractor, as referenced under Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS.

PART 3 – EXECUTION

3.1 SITE MAINTENANCE

- A. The Masonry Filed Subcontractor shall furnish and maintain dumpsters as required to adequately control the disposal of all trash, construction debris, and waste materials resulting from the work of this Filed Sub-Trade.
 1. The Masonry Filed Subcontractor is responsible for all costs to obtain, maintain and disposal of dumpsters.
 2. Disposal: Empty dumpsters on frequent regular basis as necessary to prevent overflow spillage. Legally dispose of waste off-site.
- B. Daily clean work areas. Sweep and place into the dumpster(s) furnished by this trade, all pallets, construction debris, unused masonry materials, and other waste materials resulting from the Work of this Filed Sub-Trade.
- C. After completion of the work of this Section, remove equipment, tools, and unused materials, remove all remaining waste materials and construction debris related to the work of this Filed Sub-Trade. Clean all wall, partition, and floor areas completely free from deposits of mortar, wash down residues and materials installed under this Section.

End of Section

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Section 04 01 29
RESTORATION OF UNIT MASONRY
(FILED SUB-BID REQUIRED AS PART OF SECTION 04 00 01)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Sub-Bid Requirements: As provided under Section 04 00 01 – MASONRY FILED SUB-BID REQUIREMENTS and supplemented under the Bidding Requirements, Contract Forms, and Conditions of the Contract, and applicable parts of Division 1 - GENERAL REQUIREMENTS.
 - 1. Work of this Filed Sub-Bid includes all individual specification sections listed in Section 04 00 01.

1.2 SUMMARY

- A. Provide masonry restoration work where shown on the Drawings and as specified herein; work includes, but is not limited to the following:
 - 1. Repoint and rebuild existing brick where indicated.
 - 2. Replace missing and cracked brick.
 - 3. Patch brick where damaged by the work of this Section.
 - 4. Repair previous improperly executed repairs.
- B. Repair methods: The exact repair procedures shall be reviewed in the field, based on identifications in the Drawings, and the guidelines and materials specified herein. Review all procedures with the Architect and obtain acceptance prior to commencing the work. Repair methods selected shall take into account the total construction system of the building to be repaired and the different original materials used for the main building and the various additions.

1.3 RELATED REQUIREMENTS

- A. Section 04 00 01 – Masonry Filed-Sub-Bid Requirements.
- B. Section 04 22 00 – Concrete Unit Masonry.

1.4 REFERENCES

- A. Referenced Standards: Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. The standards referenced herein are included to establish recognized minimum quality only. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern. Equivalent quality and testing standards will be acceptable, subject to their timely submission, review and acceptance by the Architect.
 - 1. Masonry Standards Joint Committee (MSJC) [The Masonry Society (TMS)/American Concrete Institute (ACI)/American Society of Civil Engineers (ASCE)]: TMS 602/ACI 530.1/ASCE 6 - "Specifications for Masonry Structures"
 - 2. American Society of Testing and Materials (ASTM), as referenced herein.

3. American National Standards Institute Building Code requirements for Masonry, ANSI 41.4.
4. ASTM C144 - Specification for Aggregate for Masonry Mortar
5. ASTM C150 -Standard Specification for Portland Cement
6. ASTM C207 - Hydrated Lime for Masonry Purposes
7. ASTM C270 -Standard Specification for Mortar for Masonry Units
8. ASTM C780 -Test for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry
9. ASTM C979 - Standard Specification for Pigments for Integrally Colored Concrete
10. BIA 1 - Technical Notes on Brick Construction, Cold Weather Masonry Construction, Introduction
11. BIA 1A - Technical Notes on Brick Construction, Cold Weather Masonry Construction, Construction and Protection Recommendations
12. US Department of Interior, National Park Service, technical preservation services: Preservation Briefs: 2, Repointing Mortar Joints in Historic Brick Buildings
13. United States Secretary of the Interior Standards for Rehabilitation Guidelines for Rehabilitating Historic Buildings.

1.5 SUBMITTALS

- A. Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
 1. Literature
 - a. Masonry materials: Product data sheets, specifications, physical properties for each item furnished hereunder.
 - 1) Manufacturer's descriptive data for materials including bricks, mortars, and mortar patching materials additives, fasteners, inserts, attachments, anchors and accessories. Descriptive data shall include test data demonstrating compliance with referenced standards. Descriptive data for premixed mortar, mortar additives shall include shelf life, curing time, mixing instructions, installation instructions and storage requirements.
 2. Material certificates: Provide for the following, signed by manufacturer and Contractor certifying that each material complies with requirements.
 - a. Masonry materials: Each different cement product required for mortar, including name of manufacturer, brand, type, and weight slips at time of delivery.
 3. Material test reports from a qualified independent laboratory employed and paid by Contractor indicating and interpreting test results relative to compliance of the following proposed masonry materials with requirements indicated:
 - a. Field prepared mortar complying with property requirements of ASTM C 270.
 4. Samples: Prepared and cured mortar samples demonstrating color and shade. The Architect reserves the right to reject samples, and request

resubmissions, until a sample having the desired color and shade is considered an acceptable match to the existing mortar

5. Samples:
 - a. Mortar: (minimum three for each mortar mix) Prepared and cured mortar samples demonstrating color and shade. Set mortar in 1/2 by 1/2 by 6 inch channels (aluminum or plastic). The Architect reserves the right to reject samples, and request resubmissions, until a sample for each mortar type has the desired color, shade, texture and composition matching the original pointing mortars.
 6. Contractor's cold weather and hot weather masonry procedures: Show evidence of compliance with requirements of ACI 530.1/ASCE 6.
 - a. The Contractor shall submit, in written form, to the Architect for review and recommendation, cold weather procedures for masonry restoration work. No masonry restoration work shall be performed in temperatures below 40 degrees Fahrenheit without the submittal to and review by the Architect of cold weather procedures.
 7. Certificates: Certificates of compliance stating that the materials meet the specified requirements for:
 - a. Mortar Coloring.
 - b. Mortar Admixtures.
 8. Workmen Qualifications:
 - a. Certificates of qualifications for Masonry Restoration Specialist, as required under the Article entitled "Qualifications" specified herein below.
- B. LEED Certification Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES and Section 01 81 13 – SUSTAINABLE DESIGN REQUIREMENTS - LEED FOR NEW CONSTRUCTION AND MAJOR RENOVATIONS
1. Credit MRc2 (Construction Waste Management):
 - a. Refer to Section 01 74 19 (Construction Waste Management and Disposal) for construction waste management submittal requirements.
 2. Credit IEQc4.1 (Low-Emitting Materials – Adhesives and Sealants):
 - a. Refer to Section 01 81 13 (Sustainable Design Requirements) for VOC content submittal requirements for field-applied interior adhesives and sealants.
 3. Credit MRc4 (Recycled Content):
 - a. Refer to Section 01 81 13 (Sustainable Design Requirements) for recycled content submittal requirements.
 4. Credit MRc5 (Regional Materials):
 - a. Refer to Section 01 81 13 (Sustainable Design Requirements) for raw material extraction and manufacturing location submittal requirements.

1.6 QUALIFICATIONS

- A. Restorer: Company specializing in performing the masonry restoration work of the type specified herein, with minimum of 5 years documented experience. Work shall be done by skilled workers, fully instructed as to the requirements Specified herein and adequately supervised during the work.

July 11, 2018

1.7 QUALITY ASSURANCE

- A. Field Supervised Work: Contractor shall notify Architect before beginning work of this Section. Obtain Architect's approval of Contractor's procedures before proceeding with the work.
- B. Single-source responsibility for mortar materials: Obtain mortar ingredients of uniform quality, including color for exposed masonry, from one manufacturer for each cementitious component and from one source and producer for each aggregate.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. General: Do not deliver cement, lime, and similar perishable materials to the site until suitable storage is available. Store such materials in weatherproof structures, and ensure that materials are in perfectly fresh condition when brought for use. Protect masonry units and manufactured products of all types from wetting by rain or snow, and keep covered when not in use.
- B. Aggregates: Deliver, store and handle aggregate materials so as to prevent contamination with earth or other foreign materials.
- C. Store cement, lime and similar products under cover and from direct contact with earth or floor slabs. Store metal accessories and the like under cover and from direct contact with ground, and in manner to prevent rust.
- D. Damaged material: Remove any damaged or contaminated materials from job site immediately, including materials in broken packages, packages containing water marks, or which show other evidence of damage, unless Architect specifically authorizes correction thereof and usage on project.

1.9 ENVIRONMENTAL CONDITIONS

- A. In ambient temperatures below 40 degrees Fahrenheit make provisions to adequately protect the masonry materials and the finished work from frost by heating materials, enclosing the work or heating the enclosed spaces. No frozen work shall be worked upon nor shall anti-freeze admixtures be permitted in the mortar mix. Any completed work found to be affected by frost shall be removed and replaced at no additional expense to the Owner.

PART 2 - PRODUCTS

2.1 MATERIAL REQUIREMENTS - LEED CERTIFICATION

- A. General: Products and materials in this Section shall meet performance criteria and contribute to sustainable design requirements, as specified in Section 01 81 13 (Sustainable Design Requirements). These contributions include, but are not limited to, pre-consumer and post-consumer recycled content percentages, regional content percentages, FSC Certified wood, and product VOC content limits.
- B. Recycled Content: Products and materials shall comply with minimum recycled content percentages as specified in 01 81 13 (Sustainable Design Requirements).

July 11, 2018

2.2 MORTAR COMPONENTS

- A. Portland Cement: Type I, or Type III, ASTM C150, non staining, white color, without air entrainment.
 - 1. Use Type III as necessary for laying masonry in cold weather.
- B. Sand: Clean, washed uniformly well graded, conforming to ASTM C 144-542.
- C. Sand shall conform to the color, grade, composition and particle sizes results of laboratory analysis
- D. Water: Clean and potable without contaminants
- E. Lime: Approved brand of plastic hydrated lime, conforming to ASTM C 207, Type "S".
- F. Oxide pigments: Oxide pigments shall be stable, non-fading, and alkali resistant, conforming to ASTM C979.
- G. Acrylic Admixture:
 - 1. Larsen Products Corp., Jessup MD., product "Acrylic Ad-Mix 101".
 - 2. TK Products (Division of Sierra Corp), Minnetonka MN., product "TK-225 Liquid Bonding Agent".
 - 3. BASF Building Systems., Shakopee MN., (Thoro Brand), product "Acryl 60".

2.3 MORTAR

- A. Mortar for pointing and setting masonry, General: Mortar mixes for pointing and setting masonry shall be hopper batch, preblended mortar to exactly match existing pointing mortar composition, formula, color, porosity, density, such as SpecMix, Inc., or approved equal. Pointing shall be completed in compliance with manufacturer's printed instructions and all materials stored, transported, and used in compliance with manufacturer's printed instructions.
- B. Mortar for pointing brick masonry:
 - 1 part by volume, White Portland Cement
 - 1 parts by volume, hydrated lime (Type S)
 - 6 parts by volume, fine sand (selected to match sand in original mortar).
 - Oxide pigments as required to match original mortar color.

2.4 MORTAR MIXES

- A. General: Measure mortar ingredients carefully to control proportions, maintain proportions through-out the work. Mix mortar with power operated batch mixer. Provide not less than 5 minutes mixing time to ensure a homogeneous plastic mortar. Provide at least 2 minutes mixing time for dry material Use a minimum amount of water to product a workable consistency for the mortars intended purpose.
- B. Mortar mix for grouting: Mix a consistency as can be readily flowed into cracks and voids.

July 11, 2018

- C. Mortar mix for slurry: Mix a consistency as can be readily applied by brush. Place within two hours of mixing, do not retemper partially hardened materials.
- D. Mortar mix for small batches: Batches less than one cubic yard may be mixed by hand with permission of Architect. Mix using clean paddles and plastic or metal mixing boxes.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive the work of this Section.
- B. Verify surfaces schedule to receive water repellent coating are dry, clean and free of efflorescence, oil or other matter detrimental to application of coating.
- C. Beginning of restoration work means acceptance of receiving surfaces and built conditions.

3.2 PREPARATION

- A. During the operation of work of this Section, protect existing materials not receiving Work of this Section at all times from mortar drippings, stains and damage by the exercise of reasonable care and precautions. Clean, or repair all existing materials which are soiled or otherwise damaged by Work of this Section, to match original profiles and finishes. Existing materials and finishes which cannot be cleaned, or repaired shall be removed and replaced with new work to match existing.
- B. Protect roofing and flashings: Protect roof membrane and flashings from damage. Lay 1/2 inch plywood on roof surfaces over full extent of work area, and beneath work areas, and along traffic route.
- C. Stain Prevention: Protect elements surrounding the work of this section from damage or disfiguration. Prevent mortar from staining the face of existing surfaces.
- D. Immediately remove stains, efflorescence or other excess resulting from the work of this Section.
- E. Provide dams to divert flowing water to existing exterior drains.

3.3 LOCATE AND MARK AREAS TO BE REPAIRED / RESTORED

- A. Work areas are approximately shown on drawing. Locate areas to be repaired / restored by sounding with a hammer to detect hollow and deteriorated areas.
- B. Mark locations using chalk or crayon.

3.4 REPAIR AND REPOINTING EXISTING MASONRY

- A. Rake out loose or disintegrated mortar, including corners and openings. During the tooling of joints, enlarge any voids or holes.
 - 1. Rake out loose or disintegrated mortar in joints to a depths specified, including corners and openings. During the tooling of joints, enlarge any voids or holes.

2. All joints shall be raked to a minimum 3/4 inch depth, but in all cases all weathered and loose material shall be removed.
 3. Special precautions shall be taken to ensure that brick faces and rubble stone shapes and profiles are not damaged during the process of raking out or repointing.
- B. Remove loose and disintegrated mortar beyond the raked-out depth.
- C. Power grinders shall not be used to remove mortar from joints less than 5/16 inch wide or for the raking out of vertical (head) mortar joints. For narrow joints 1/8 inch or less, mortar shall be raked out manually with a sharp knife blade or cutter made for this purpose. The cutter may be used with or without the aid of a hammer.
1. Do not use blades thicker than 3/32 inch for scoring joints.
 2. The initial power tool cut shall be in the center of the joint. Remove the remaining mortar using hand tools. The Contractor shall set the depth of the blade so that the resulting kerf does not exceed the minimum depth.
 3. Stop the kerf a minimum 3/4 times the blade diameter from inside corners and projecting elements. Remove the remaining mortar using hand tools.
 4. The Contractor may construct jigs to guide the power tools and to prevent damage to adjacent masonry.
- D. Do not damage existing masonry units. Sound brick damaged by the cutting process shall be replaced at the Contractor's expense.
1. All raking shall cease if, in the judgment of the Architect, the methods employed by the Contractor are causing damage to the brick or stone. No work shall commence until tools, workmen, and methodology are corrected to meet the quality standard of the test panel
- E. When cutting is complete, remove dust and loose material by pressured air or brushing.
- F. Prior to repointing, premoisten joints (free of standing water).
1. Do not damage existing masonry units. Sound brick damaged by the cutting process shall be replaced at the Contractor's expense. Remove all mortar from the surface of the brick within the joint so that new mortar bonds directly to brick.
 2. The Contractor shall replace all brick damaged during the raking process at no cost to Owner.
 3. All raking shall cease if, in the judgment of the Architect, the methods employed by the Contractor are causing damage to the brick or stone. No work shall commence until tools, workmen, and methodology are corrected to meet the quality standard of the test panel.
 4. When cutting is complete, remove dust and loose material by pressured air or brushing. Remove all mortar and foreign material from raked joints; clean joint edges; use fine brush or compressed air to remove granular particles and dust.
- G. Prepare Joints: Premoisten joints (free of standing water).

July 11, 2018

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- H. Repoint Joints: Pack joints, holes and cracks tightly with specified mortar in maximum 1/4 inch layers. Pack back corners of joints.
 - I. Pack joints, holes and cracks tightly with specified mortar in maximum 3/8 inch layers. Pack back corners of joints.
 - 1. First apply mortar to areas where the existing mortar is either missing, or depth is greater than 1 inch.
 - 2. Permit each layer to become stiff (thumb print hardness) before applying next layer.
 - 3. Where existing masonry units have worn and rounded corners, recess the final layer slightly, so as not to fill in the worn areas.
 - 4. Perform work with fresh mortar; do not use dead mortar droppings. Do all pointing while mortar is still soft and plastic. If hardened, chisel defect out and refill solidly with fresh additional mortar.
 - 5. Leave a smooth, uniform appearance, compacted and tooled to match original appearance of joints. After tooling, brush lightly mortar joints to roughen mortar surface slightly, to simulate natural weathering of existing adjacent mortar
 - 6. Moist cure for 72 hours.
 - J. Additionally to repointing work, remove and replace existing bricks which are loose, cracked through, or otherwise seriously deteriorated as determined by the Architect. Install in fresh mortar, pointed to eliminate evidence of replacement. Replace removed brick with new or salvaged brick to match bonding and coursing pattern of existing brick.

3.5 MASONRY REMOVAL AND REBUILDING

- A. Brick Removal:
 - 1. Carefully remove by hand at locations indicated any brick which are damaged, cracked or deteriorated. Cut out full units from joint to joint and in manner to permit replacement with full size units.
 - 2. Support and protect masonry indicated to remain which surrounds removal area.
 - 3. Salvage as many whole, undamaged bricks as possible.
 - 4. Remove mortar, loose particles and soil from salvaged brick by cleaning with brushes and water. Store brick for reuse.
 - 5. Clean remaining brick at edges of removal areas by removing mortar, dust, and loose debris in preparation for rebuilding.
- B. Brick Rebuilding:
 - 1. Install new or salvaged brick to replace removed brick. Fit replacement units into bonding and coursing pattern of existing brick. If cutting is required use motor driven saw designed to cut masonry with clean, sharp unchipped edges.
 - 2. Lay replacement brick with completely filled bed, head and collar joints. Butter ends with sufficient mortar to fill head joints and shove into place. Wet clay brick which have ASTM C-67 initial rates of absorption (suction) of more than 30 grams over 30 square inches. per minute. Use wetting methods which

insure that units are nearly saturated but surface dry when laid. Maintain joint width for replacement units to match existing.

3. Tool exposed mortar joints in repaired area to match joints of surrounding existing brickwork.
4. Repoint new mortar joints in repaired area to comply with requirements for repointing existing masonry. Ë

3.6 AGING REPOINTED MASONRY

- A. Dust new mortar repointing work to match existing adjacent masonry as closely as possible, to the approval of the Architect.
- B. Use carbon black in small amounts, rubbing in well with medium bristle brush
- C. After each application, dust off surplus and wash down with low pressure hose. Allow surface to dry before proceeding with succeeding applications.

3.7 FIELD QUALITY CONTROL

- A. Mortar composition and properties will be evaluated per ASTM C 780.
- B. Evaluation of Quality Control tests: In absence of other indications of noncompliance with requirements, masonry will be considered satisfactory if results from construction quality control tests comply with minimum requirements indicated.

3.8 CLEANING

- A. As work proceeds and on completion of work, remove excess mortar, droppings, smears, stains, efflorescence, or other unsightly excess resulting from the work of this Section.
- B. Clean surrounding surfaces.
- C. Use non-metallic tools in cleaning operations. Cleaning methods are subject to Designer's approval.
- D. Daily: sweep up and remove; mortar droppings, sand, cleaning compounds, and mixtures, dirt debris and rubbish.

End of Section

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Section 04 20 00
REINFORCED MASONRY
(FILED SUB-BID REQUIRED AS PART OF SECTION 04 00 01)

PART 1 - GENERAL

1.00 GENERAL PROVISIONS

- A. Sub-Bid Requirements: As provided under Section 04 00 01 – Masonry Filed Sub-Bid Requirements and supplemented under the Bidding Requirements, Contract Forms, and Conditions of the Contract, and applicable parts of Division 1 - General Requirements.
 - 1. Work of this Filed Sub-Bid includes all individual specification sections listed in Section 04 00 01.

1.01 REFERENCE

- A. The GENERAL DOCUMENTS, as listed on the Table of Contents, and applicable parts of Division 1, General Requirements, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this trade.

1.02 SCOPE OF WORK

- A. The work of this section consists of the installation of all structural reinforced masonry.
- B. Install steel angle lintels, furnished under Section 055000 Miscellaneous Metals.

1.03 RELATED WORK UNDER OTHER SECTIONS

- A. The following items of related work are specified and included in other sections of the Specifications:
 - 1. Concrete Work SECTION 033000
 - 2. Miscellaneous Metals SECTION 055000

1.04 SUBMITTALS

- A. Shop drawings: Submit complete shop drawings of this section to Architect for approval. Shop drawings shall include reinforcement, mortar, grout, and accessories.

1.05 DELIVERY AND STORAGE

- A. Deliver reinforcing to the site, bundled, tagged and marked. Store reinforcing off the ground, and keep covered. Immediately before placing, clean loose rust, dirt or other coatings from reinforcing, which will reduce the bond.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Reinforcing Bars shall be of size shown and to conform to ASTM A615, Grade 60.

B. Grout Materials

1. Portland Cement shall conform to ASTM C150, Type I.
2. Fine Aggregate shall be a clean, washed, well-graded sand complying with ASTM C404.
3. Coarse Aggregate shall be a clean, washed, well-graded crushed stone or pea gravel complying with ASTM C404.
4. Grout mix shall comply with ASTM C476, as follows:
 - a. Fine Grout: 1 Part Portland Cement to 1/10 part hydrated lime to 3 parts fine aggregate.
 - b. Coarse Grout: 1 part Portland Cement to 1/10 part hydrated lime to 2 1/4 to 3 parts of fine aggregate and 1 to 2 parts of coarse aggregate.
5. Grout Mix shall have minimum 8" and maximum 10" slump. Minimum compressive strength of grout at 28 days to be 2500 psi.

C. MORTAR

1. Mortar shall comply with ASTM C270, BIA Technical Note 8 and 8A, and Massachusetts State Code Section 815.0: Use type S mortar, minimum compressive strength 1800 psi. Do not use masonry cement.
2. Cement shall be an American Portland cement conforming to ASTM C150, Type I.
3. For exterior masonry, the cement shall fulfill the further requirements that it shall exhibit no efflorescence when cast into the form of 2 in. by 7 in. slabs comprising the cement under test, Ottawa plastic mortar sand and distilled water (in proportions of 1:2 by weight, with water added to produce 100% flow) and subjected to a 7-day "wick test" in general conformity with the methods described in ASTM C67.
4. Lime shall be plastic hydrate conforming to ASTM C207, Type S (only).
5. Sand shall be clean, washed, uniformly well graded masonry sand conforming to the requirements of ASTM C144 with the further requirement that the fineness modulus shall be maintained at 2.25 plus/minus 0.10. Sand shall be from a single source meeting these requirements and as approved by the Architect after laboratory test.

Source of supply shall not be changed during the course of job without written consent of the Architect.

D. CONCRETE MASONRY UNITS

1. Concrete Masonry Units (CMU) shall be moisture controlled, normal weight concrete units conforming to Grade N, Type 1 of ASTM C90 for hollow Load-Bearing CMU with a minimum compressive strength of 1900 psi. or $F'm=1500$ psi. Aggregate shall conform to ASTM C33. Units for fire-rated walls shall comply with Code requirements.

E. ACCESSORIES

1. Joint Reinforcements

- a) Provide joint reinforcement in all CMU masonry construction and to tie brick wythes together at reinforced brick masonry, if any.
- b) Joint reinforcements shall be manufactured from cold drawn steel wire conforming to ASTM A82 and shall consist of two deformed longitudinal rods welded at 16 in. intervals in the same plane to cross rods. Rods shall be No. 9 gauge. Width of reinforcement shall be 1-1/2 in. to 2 in. less than thickness of wall or wythe as applicable. Acceptable products include, but are not limited to: Standard Truss by Dur-O-Wall, Block Truss AA600 by AA Wire Products, Regular Truss Ty by Ty-Wall, Truss Type by Wire Bond, or equal.
- c) For cavity walls, joint reinforcement shall have an additional wire loop with eye holes formed at ends for use with adjustable masonry ties, welded at 24" intervals along joint reinforcing. Acceptable products include, but are not limited to: Dur-O-Eye as manufactured by Dur-O-Wall, Adjustable Econo-Blok-Truss AA650 as manufactured by AAWire Products Company, Truss with Adjustable Double Hook and Eye by Wire Bond, Adjustable truss Tab-Ty as manufactured by Ty-Wall, or equal.
- d) Reinforcement for exterior walls shall be hot-dip galvanized after fabrication with 1.5 oz. zinc coating complying with ASTM A 153, Class B2. Reinforcement for interior walls and partitions may be uncoated steel.
- e) Prefabricated or job fabricated corner and tee sections shall be used to form continuous reinforcement around corners, and for anchoring abutting walls and partitions. For corners and intersecting walls provide vertical reinforcing in each cell and tie with number 3 ties for continuous corner reinforcing.

PART 3 - EXECUTION

July 11, 2018

3.01 CMU MASONRY

- A. Lay masonry units in running bond, with vertical joints in each course centered on units in courses above and below. Do not wet masonry units.
- B. Maintain vertical continuity of cells to be reinforced and grouted. Cells shall provide a cavity at least 2-1/2 in. by 3 in. in size at exterior walls.
- C. Cores at exterior wall without grout may be filled with pourable insulation. Review with architectural details.
- D. Admixtures and Antifreeze Compounds shall not be used.

3.02 GROUT MIX

- A. Use methods which will ensure that specified proportions are controlled and accurately maintained. Measure aggregate material in a damp, loose condition.
- B. Mix grout to have a slump of 9 in. plus/minus 1 in.

3.03 PLACING REINFORCING

- A. Do not bend or cut off dowels protruding from concrete foundation wall or slab; break masonry unit web if conflict with dowel occurs at reinforced cavities.
- B. Position reinforcing accurately using the sizes and spacings of bars shown on drawings.
- C. Maintain 1 in. minimum clearance on all sides of reinforcing bars. Support and secure bars against displacement during grouting.
- D. Bars shall be a minimum of 4'-0" long and shall be lapped a minimum of 2'- 0" at splices.

3.04 PLACING GROUT

- A. Low lift grouting
 - 1. Build masonry walls to a height not exceeding 4'- 0". Insert steel reinforcing in proper cavities. Pour grout in cavities which contain reinforcing. Fill cavities to 2" plus/minus 1/2" of top of CMU or to a level which will allow for a 2'-0" lap when next bar is inserted. Repeat operation by laying masonry units in 4 ft. lifts.
 - 2. Do not pour grout until mortar on masonry wall has cured 24 hours.
 - 3. Move the grout from the mixer to the point of deposit as fast as practical. Discard grout not placed within 1-1/2 hours after water is first added to the batch. Use placing methods, which prevent segregation of the mix.

4. Vertical cores to be filled shall have an unobstructed alignment with minimum dimension of 2.5" and minimum 8 square inches. Thoroughly puddle each pour to insure complete filling of the grout space.
 - a. Grout shall be placed by practical means. Grout may be poured in place, pressured-grouted by gravity, or pumped. Use of pneumatic pressure or dry-packed grouting requires approval of Architect.
 - b. Grout shall be poured from one side only, so as to flow across to open side to avoid air entrapment. Rod or vibrate grout during placing.
5. Finishing Unconfined Grout
 - a. After grout has acquired its initial set and will not sag, all unconfined, exposed edges shall be cut off, leaving sloping "shoulder". Entire exposed area shall then be painted within 24 hours with a vapor-proof paint or plastered with a Portland cement-sand mortar.

B. High Lift Grouting:

1. Use high lift grouting with approval of Architect following procedures as noted herein:
 - a. Vertical cores shall have unobstructed alignment with minimum dimension of 3 inches and minimum area of 10 square inches.
 - b. Remove all mortar droppings and debris through cleanout openings.
 - c. Clean outs shall be located at the bottom of every core of 3 inch by 4 inch size.
 - d. Clean cells with high pressure water spray. Permit complete water drainage. Have cells inspected by owner's representative prior to filling with grout.
 - e. Pump grout into cells. Limit lift to 8 feet and rod for consolidation.

3.05 CURING

- A. Moist cure with continuously wet burlap, or by equivalent approved method, for not less than 72 hours at temperature of not less than 50 degrees F. Provide enclosures for cold weather construction. When air temperature is below 32 degrees F, heat materials and use insulated blankets to maintain temperature above 32 degrees F. When air temperatures are below 20 degrees F, provide heated enclosures. Follow recommendations of Table 5-1 CONCRETE MASONRY HANDBOOK OF PCA.

End of Section

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Section 04 22 00
CONCRETE UNIT MASONRY
(FILED SUB-BID REQUIRED AS PART OF SECTION 04 00 01)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Sub-Bid Requirements: As provided under Section 04 00 01 – MASONRY FILED SUB-BID REQUIREMENTS and supplemented under the Bidding Requirements, Contract Forms, and Conditions of the Contract, and applicable parts of Division 1 - GENERAL REQUIREMENTS.
1. Work of this Filed Sub-Bid includes all individual specification sections listed in Section 04 00 01.

1.2 SUMMARY

- A. Furnish and install:
1. Concrete unit masonry construction partitions.
 2. Grout fill for hollow metal steel frames, and wherever ties or anchorage items occur, and as further indicated in the Drawings.
 3. Reinforcing, ties, anchors, and other metal accessories, for anchoring unit masonry together and to other materials.
 4. Compressible joint fillers for control joints in unit masonry work and joints with structural steel.
 5. Built-in masonry flashing.
 6. Control joints in concrete masonry.
- B. Place, install and build-in, as work progresses, the following products and materials furnished under the indicated Sections:
1. Anchor bolts, wood blocking, and anchorage items furnished or set by other trades as specified in individual Sections.
 2. Steel lintels furnished by Section 05 50 00 - METAL FABRICATIONS.
 3. Access door frames furnished by Section 08 31 00 - ACCESS DOORS AND PANELS or by section requiring the same.
- C. Build-into place as work progresses, the following products and materials furnished under the indicated Sections:
1. Hollow metal door and window frames set-in-place by Section 06 10 00 - ROUGH CARPENTRY, and furnished by Section 08 11 13 - HOLLOW METAL DOORS AND FRAMES.
- D. Clean and point exposed to view surface masonry.

1.3 RELATED REQUIREMENTS

- A. Section 03 30 00 - CAST-IN-PLACE CONCRETE: Concrete foundation work, walls and slabs.

July 11, 2018

- B. Section 05 12 00 - STRUCTURAL STEEL: Welding of masonry anchors to structural steel.
- C. Section 05 50 00 - METAL FABRICATIONS: Steel lintels at masonry openings.
- D. Section 06 10 00 - ROUGH CARPENTRY: Setting and temporary bracing of hollow metal frames occurring in masonry, and removal of temporary centering when frames have been built into the masonry.
- E. Section 07 84 00 - FIRESTOPPING.
- F. Section 07 92 00 - JOINT SEALANTS: Sealant, caulking materials, and compressible joint bead back-up, in conjunction with masonry work.
- G. Section 08 11 13 - HOLLOW METAL DOORS AND FRAMES.

1.4 REFERENCES

- A. Referenced Standards: Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. The standards referenced herein are included to establish recognized minimum quality only. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern. Equivalent quality and testing standards will be acceptable, subject to their timely submission, review and acceptance by the Architect.
 1. Masonry Standards Joint Committee (MSJC) [The Masonry Society (TMS)/American Concrete Institute (ACI)/American Society of Civil Engineers (ASCE)]: TMS 602/ACI 530.1/ASCE 6 - "Specifications for Masonry Structures"
 2. ASTM A 82 - Steel Web, Plain, for Concrete Reinforcement.
 3. ASTM A 123 - Zinc (Hot-Dip Galvanized) Coating on Iron and Steel Products.
 4. ASTM A 153 - Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
 5. ASTM A 497 - Welded Wire Fabric; Deformed, for Concrete Reinforcement.
 6. ASTM A 615 - Deformed and Plain Billet-Steel Bar for Concrete Reinforcement.
 7. ASTM A 641 - Zinc-Coated (Galvanized) Carbon Steel Wire.
 8. ASTM B 117 - Salt Spray (Fog) Testing.
 9. ASTM B 633 - Electrodeposited Coatings of Zinc on Iron and Steel.
 10. ASTM C 5 - Quicklime for Structural Purposes.
 11. ASTM C 90 - Load-Bearing Concrete Masonry Units.
 12. ASTM C129 - Non-Load Bearing Concrete Masonry Units.
 13. ASTM C 140 - Method of Sampling and Testing Concrete Masonry Units.
 14. ASTM C 144 - Aggregate for Masonry Mortar.
 15. ASTM C 150 - Portland Cement.
 16. ASTM C 207 - Hydrated Lime for Masonry Purposes.
 17. ASTM C 270 - Mortar for Unit Masonry.
 18. ASTM C 387 - Packaged, Dry, Combined Materials, for Mortar and Concrete.

19. ASTM C 404 - Aggregates for Masonry Grout.
20. ASTM C 476 - Grout for Masonry
21. ASTM C 578 - Preformed, Cellular Polystyrene Thermal Insulation.
22. ASTM C 595 - Blended Hydraulic Cement.
23. ASTM C 744 - Prefaced Concrete and Calcium Silicate Masonry Units.
24. ASTM C 778 – Specification for Standard Sand.
25. ASTM C 780 - Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry.
26. ASTM C 954 - Steel Drill Screws for the Application of Gypsum Board or Metal Plaster Bases to Steel Studs.
27. ASTM C 1019 - Method of Sampling and Testing Grout.
28. ASTM C 1072 - Method for Measurement of Masonry Flexural Bond Strength.
29. ASTM C 1093 - Standard Practice for Accreditation of Testing Agencies for Masonry.
30. ASTM C 1329 – Standard Specification for Mortar Cement.
31. ASTM C 1357 – Test Methods for Evaluating Masonry Bond Strength.
32. ASTM D 2000 - Classification System for Rubber Products.
33. ASTM D 2287 - Nonrigid Vinyl Chloride Polymer and Copolymer Molding and Extrusion Compounds.
34. ASTM E 119 - Fire Tests of Building Construction and Materials.
35. ASTM E 447 - Compressive Strength of Masonry Prisms.
36. ASTM E 488 - Strength of Anchors in Concrete and Masonry Elements.
37. ASTM E 518 - Test Method for Flexural Bond Strength of Masonry.
38. American National Standards Institute Building Code requirements.
39. MCAA – Hot and Cold Weather Masonry Construction.

- B. The following reference materials are hereby made a part of this Section by reference thereto:
1. UL Fire Resistance Directory.
 2. IMI: Masonry Construction Guide Manual.
 3. PCA, "Concrete Masonry Handbook".
 4. NCMA applicable TEK Bulletins.
 5. NCMA TEK Bulletin N°. 45 - Removal of Stains from Concrete Masonry Walls.

1.5 SUBMITTALS

- A. Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
1. Literature: Manufacturer's product data sheets, specifications, performance data, physical properties for each item furnished hereunder.
 2. Material certificates: Provide for the following, signed by manufacturer and Contractor certifying that each material complies with requirements.

- a. Provide fabricators UL certificates for rated concrete masonry units, submit for UL-assembly compliance for each indicated fire rating.
 - b. Each different cement product required for mortar and grout, including name of manufacturer, brand, type, and weight slips at time of delivery.
 - c. Each material and grade indicated for reinforcing bars.
 - d. Each type and size of joint reinforcement.
 - e. Each type and size of anchors, ties, and metal accessories.
3. Material test reports from a qualified independent laboratory employed and paid by Contractor indicating and interpreting test results relative to compliance of the following proposed masonry materials with requirements indicated:
- a. Mortar complying with the property requirements of, and tested in accordance with ASTM C 270.
 - b. Mortar complying with the proportion requirements of ASTM C 270 and tested in accordance with ASTM C 780.
 - c. Grout mixes: Include description of type and proportions of grout ingredients.
 - d. Masonry units; report for tests performed within the previous six months.
4. Certification:
- a. Provide manufacturer's written certification of recycled steel content for reinforcing steel.
 - b. Provide manufacturer's written certification of recycled content for concrete masonry units.
5. Shop drawings:
- a. Provide elevations of masonry work showing jointing patterns and coursing; indicate locations of expansion and control joints.

1.6 QUALIFICATIONS

- A. Installer: Company specializing in performing the masonry work of this Section with minimum of 10 years documented experience. Work shall be done by skilled workmen, fully instructed as to the requirements of this Specifications and adequately supervised during the work.

1.7 QUALITY ASSURANCE

- A. Single-source responsibility:
1. Facing units: Obtain exposed masonry units of uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from one manufacturer for each different product required for each continuous surface or visually related surfaces.
 2. Concrete masonry units: Obtain concrete masonry units for the project from a single manufacturer.
 3. Mortar materials: Obtain mortar ingredients of uniform quality, including color for exposed masonry, from one manufacturer for each cementitious component and from one source and producer for each aggregate.

July 11, 2018

4. Prepackaged mortar materials: Obtain masonry cement or masonry mortar from a single manufacturer. Where colored mortar is required provide batch tickets confirming all materials are from a single production run to ensure uniformity of the mix.
- B. Inspection, Testing, and Quality Control: A program of Inspection and Testing of structural masonry work will be established by the Structural Engineer of Record (SER) who will direct the implementation of tests as carried out by an independent testing agency. All costs for inspection and testing will be borne by the Owner.

1.8 REGULATORY REQUIREMENTS

- A. Fire performance characteristics: Where indicated, provide materials and construction identical to those of assemblies whose fire resistance has been determined per ASTM E 119 by a testing and inspecting organization, by equivalent concrete masonry thickness, or by another means, as acceptable to authorities having jurisdiction.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. General: Do not deliver cement, lime, and similar perishable materials to the site until suitable storage is available. Store such materials in weatherproof structures, and ensure that materials are in perfectly fresh condition when brought for use. Protect masonry units and manufactured products of all types from wetting by rain or snow, and keep covered when not in use.
- B. Masonry Face Units: Handle all masonry units carefully in transit and on the site, so as to keep units whole, with edges sharp, and faces clean and undamaged. Deliver all masonry units on pallets; or handle units individually, and properly stack same.
- C. Aggregates: Deliver, store and handle aggregate materials so as to prevent contamination with earth or other foreign materials.
 1. Store cement, lime and similar products under cover and from direct contact with earth or floor slabs.
- D. Manufactured items: Deliver manufactured products in original containers plainly marked with product identification and manufacturer's name.
 1. Store metal accessories and the like under cover and from direct contact with ground, and in manner to prevent rust.
- E. Damaged material: Remove any damaged or contaminated materials from job site immediately, including materials in broken packages, packages containing water marks, or which show other evidence of damage, unless Architect specifically authorizes correction thereof and usage on project.

1.10 ENVIRONMENTAL CONDITIONS

- A. Hot and cold weather requirements shall be in accordance with the recommendations of the Masonry Industry Council as contained in the document "*HOT AND COLD WEATHER MASONRY CONSTRUCTION*" published by the MCAA (Masonry Contractor's Association of America). Enforcement for these requirements shall take place under the following conditions which modify those in the referenced document.

1. The recommended hot weather requirements for 100 degrees Fahrenheit (37.8 degrees Celsius) shall be enforced for this project when ambient temperatures are above 90 degrees Fahrenheit (32.2 degrees Celsius) under all wind conditions including zero velocity.
2. Cold weather requirements shall be enforced when ambient temperatures fall below 40 degrees Fahrenheit (4.4 degrees Celsius).

1.11 COORDINATION

- A. Coordinate work with that of other trades which require placement and building-in of, as work progresses, anchor bolts, wood blocking, hollow metal frames, and anchorage items.
- B. Examine all Drawings as to requirements for the accommodation of work of other trades. Provide all required recesses, chases, slots, and cutouts. Place anchors, bolts, sleeves and other items occurring in the masonry work. Take every precaution to minimize future cutting and patching. Closely coordinate the location and placement of such items.

PART 2 - PRODUCTS

2.1 CONCRETE MASONRY UNITS

- A. Load bearing hollow and solid, normal weight concrete masonry units: Conform to ASTM C90, Type 1, Class 1, normal weight.
 1. Plain-faced units of nominal thickness indicated on the Drawings, nominal 8 by 16 inch face dimension with light gray color and uniform medium-fine texture, sound, true to plane and line, and free from chips, cracks, and other defects.
 - a. Types required, wythe (depth) and fire resistant construction rating as indicated on Drawings.
 - b. Recycled content: Use maximum available percentage of recycled materials. Concrete masonry units incorporated into the work shall contain not less than 3 percent of recycled content.
 2. Aggregate: sand and gravel: conform to ASTM C 33.
 3. Minimum allowable compressive strength for an individual unit of not less than 1700 psi (net area); and not less than 1,900 psi. (net area) for average of 3 units; when tested in accordance with ASTM C 140.
 4. Oven dry density: 125 pounds per cubic foot.
 5. Moisture content for average of 3 units, when delivered, not exceeding 35 percent of the total absorption, when tested in accordance with ASTM C 140.
- B. Non-loadbearing concrete masonry units (at interior non-load-bearing partitions only): Conform to ASTM C129, Type 1, normal weight concrete masonry units:
 1. Plain-faced units of nominal thickness indicated on the Drawings, nominal 8 by 16 inch face dimension with light gray color and uniform medium-fine texture, sound, true to plane and line, and free from chips, cracks, and other defects.
 - a. Types required, wythe (depth) and fire resistant construction rating as indicated on Drawings.

- b. Recycled content: Use maximum available percentage of recycled materials. Concrete masonry units incorporated into the work shall contain not less than 3 percent of recycled content.
 - 2. Aggregate: sand and gravel,
 - a. Normal weight block: conform to ASTM C 33.
 - b. Light weight bock: conform to ASTM C 331.
 - 3. Minimum allowable compressive strength for an individual unit of not less than 500 psi (net area); and not less than 600 psi. (net area) for average of 3 units; when tested in accordance with ASTM C 140.
 - 4. Oven dry density:
 - a. Normal weight units: 125 pounds per cubic foot
 - b. Light weight units: 105 pounds per cubic foot
 - 5. Moisture content for average of 3 units, when delivered, not exceeding 35 percent of the total absorption, when tested in accordance with ASTM C 140.
 - 6. Provide units clearly labeled as non-load-bearing.
- C. Concrete Building Brick: ASTM C55 and characteristics indicated below for grade, type, size and weight classification.
 - 1. Grade: N.
 - 2. Type: moisture controlled units, Type 1.
 - 3. Size: modular, 2-1/4" x 3-5/8" x 7-5/8".
 - 4. Weight classification: Same as for concrete block.
- D. Concrete masonry grout blocks: Open end high strength concrete masonry units and slot type strength concrete masonry units for use at reinforced concrete masonry construction where indicated on the Drawings. Conform to all requirements specified above for standard concrete masonry units, and the following additional requirements:
 - 1. Plain-faced units of nominal thickness indicated on the Drawings, nominal 8 by 16 inch face dimension with light gray color and uniform medium-fine texture, sound, true to plane and line, and free from chips, cracks, and other defects.

2.2 MORTAR

- A. Prepackaged mortar (ready mix) complying with ASTM C 1142, or site-mixed portland cement mortar complying with ASTM C 270 may be used.
 - 1. Admixtures are not permitted except where expressly specified herein or as otherwise approved by Architect for specific field conditions.
 - 2. Color and texture: .
- B. Mortar materials for site mixed mortar:
 - 1. Portland cement for masonry conforming to ASTM C 150, Type I, non-staining, without air entrainment. Use Type III as necessary for laying masonry in cold weather.
 - a. For concrete masonry, use gray color Portland cement

July 11, 2018

2. Aggregates for grout: Conforming to ASTM C 144 for fine aggregate and ASTM C 404, Size 8 or 89.
3. Aggregate for concrete masonry mortar: Clean, washed uniformly well graded sand conforming to ASTM C 144, with the following gradation, and having a fineness modulus between 2.15 and 2.35:

Sieve Size	Percentage Passing
#4	100%
#8	95 to 100%
#16	70 to 100%
#30	40 to 75%
#50	10 to 35%
#100	2 to 15%
#200	0 to 5%
4. Lime: Approved brand of plastic hydrated lime, conforming to ASTM C 207, Type "S".
5. Water: Clean and fresh without contaminants.

C. Prepackaged mortar (ready mix)

1. General: complying with ASTM C 1142, factory blended consisting of:
 - a. Portland cement: Comply with ASTM C 150, Type I.
 - b. Hydrated lime: Type S, complying with ASTM C 207.
 - c. Aggregate: Provide clean, sharp, well graded aggregate free from injurious amounts of dust, lumps, shale, alkali, surface coatings, and organic matter, and complying with ASTM C144.
 - d. Admixtures: Prepackaged mortar mixes contain manufacturer's own proprietary admixtures, additional field admixtures are strictly prohibited.
 - e. Water: Provide water free from deleterious amounts of acids, alkalis, and organic materials. Water shall be potable.

D. Mortar types:

1. Mortar for masonry below grade or in contact with earth: ASTM C 270 type M using the property specification.
2. Mortar for load bearing masonry: ASTM C 270 type M [S] using the property specification.
3. Mortar for non-load bearing masonry above grade: ASTM C 270 type N using the property specification.
4. Mortar for pointing, dirt and stain resistant type: ASTM C 270 type N using the property specification with added aluminum tristearate, calcium stearate, or ammonium stearate to a quantity of 3 percent of Portland cement weight.

2.3 GROUT MIXES

- A. Prepackaged grout (ready mix) complying with ASTM C 1107, or site-mixed Portland cement grout complying with ASTM C 476 may be used.
- B. Grout for setting equipment, anchor bolts, elevator guide rails, structural steel elements and miscellaneous metals: Non-metallic high-strength controlled

expansion grout of flowable consistency, having a compressive strength of 6,500 pounds per square inch (44.9 MPa) at 28 days; slump 8 to 10 inches.

1. Basis of Design: Five Star Products, Inc., Fairfield CT, product "Five Star Grout."
 2. L&M Construction Chemicals, Omaha NE, Product: "Crystex."
 3. Master Builders, Cleveland, OH, product "Masterflow 713".
 4. Sika Corporation, Lyndhurst, NJ, product "SikaGrout 212".
 5. Sonneborn Building Products, Minneapolis, MN, product "SonogROUT 10K".
 6. Symons Corporation, DesPlaines, IL, product "Symons Multi Purpose Grout".
- C. Grout for engineered masonry (core fill): Course grout having a compressive strength of 2,000 to 2,250 pounds per square inch (13.8 to 15.5 MPa) at 28 days; slump 8 to 10 inches.
1. Use 1/3 fly ash cement replacement in grout for exposed walls to reduce risk and intensity of efflorescence. Comply with ASTM C 476, for fine grout.
 - a. Proportions by volume 1:1/3:3 (Portland cement, fly ash, sand).
 - b. Fly ash: Class F.
- D. Grout for bond beams and lintels: Fine grout having a compressive strength of 2,500 to 3,000 pounds per square inch (17.2 to 20.6 MPa) at 28 days; slump 8 to 10 inches.

2.4 REINFORCEMENT AND ANCHORAGE MATERIALS

- A. Single wythe longitudinal reinforcement for concrete masonry unit walls and partitions: in overall width 1-5/8 inches less than the overall wall thickness, as manufactured by Dur-O-Wal, Hohmann, AA Wire, or equal.
1. Interior partitions: Ladder design, 9 gage ASTM A 641 class 1 galvanized wire.
 2. Exterior partitions: Ladder design, 9 gage ASTM A 641 class 3 hot dipped galvanized wire.
- B. Reinforcing steel, additional to rods which are embedded in concrete: As specified under Section 033000 - CAST-IN-PLACE CONCRETE, with additive requirement of incorporating recycled steel.
1. Recycled content of Steel: Use maximum available percentage of recycled steel. Reinforcing steel incorporated into the work shall contain not less than 60 percent of recycled scrap steel.

2.5 ACCESSORIES

- A. Compressible filler: Closed cell polyvinyl chloride; oversized 50 percent to joint width; self-expanding, continuous in length, and in width to fill the joint to a point 3/4 inch back from each face of wall or partition.
- B. Compressible filler for joints at tops of non-load bearing masonry partitions, and for expansion joints in masonry walls: Closed cell Neoprene or PVC foam board, soft grade, 25 percent thicker than joint width, continuous in length, and in width to fill the joint to a point 3/4 inch back from each face of wall or partition.

July 11, 2018

- C. Premolded control joints for concrete masonry construction: Solid rubber of profile as indicated (to maintain lateral stability of wall), 60-80 shore A hardness.
- D. Building paper (to maintain joints open for subsequent application of sealant and backer rod): N°. 15 asphalt saturated felt.
- E. Cleaning solution: Non-acidic, not harmful to masonry work or adjacent materials.

2.6 MIXING MORTARS AND GROUT

- A. General: Mix mortar and grout in accordance with the requirements of ASTM C270, and ASTM C476 as applicable.
 - 1. Control batching procedure to ensure proper proportions by measuring materials by volume. Amount of mixing water and mortar consistency shall be controlled by mason.
 - 2. Control batch sizes to allow for use within manufacturer's recommended pot life.
 - 3. Retempering will be permitted only within the first two hours of initial mix or shorter times as directed by manufacturers.
 - 4. Discard all mortar and grout which exceeds the time limits allowed by the manufacturer .Discard mortar that has partially set.
- B. Maintain sand uniformly damp immediately before mixing process.
- C. Add mortar color and admixtures in accordance with manufacturer's instructions. Provide uniformity of mix and coloration.
- D. Do not use anti-freeze compounds to lower the freezing point of mortar or grout.
- E. Pouring grout shall be fluid consistency (as fluid as possible for pouring without separation of constituent parts).

2.7 SOURCE QUALITY CONTROL

- A. Preconstruction testing: Except for testing by the Contractor, required as part of this Section, or Section 014529 – TESTING LABORATORY SERVICES, the Owner will employ and pay a qualified independent testing laboratory to perform the following preconstruction testing indicated as well as other inspecting and testing services required by referenced unit masonry standard or indicated herein for source quality control:
 - 1. Concrete Masonry Unit Tests: For each different concrete masonry unit indicated, units will be tested for strength, absorption, and moisture content per ASTM C 140.
 - 2. Mortar efflorescence: Test each mortar type which will be exposed to weather for efflorescence in accordance with the "Wick test" procedure in BIA Research Report Number 15, The Causes and Control of Efflorescence in Brickwork", Section 4.4. Mortar mixes which show efflorescence shall not be used in the Work.
 - 3. Mortar composition and properties will be field evaluated per ASTM C 780 for compressive strength, consistency, mortar aggregate ratio, water content, air content, and splitting tensile strength.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive the work of this Section.
- B. Verify built-in and other items provided by separate Sections of the work are properly sized and located.
- C. Verify foundation walls supporting masonry is constructed within tolerances required by code
- D. Beginning of installation means acceptance of site conditions.

3.2 PREPARATION

- A. Direct and coordinate placement of metal anchors supplied to other Sections.
- B. Foundations:
 - 1. Do not commence installation until foundations are clean, rough, and level.
 - 2. Sandblast the foundation tops, if necessary, and remove all laitance and foreign material.
 - 3. Verify that the foundation elevation is such that the bed joint thickness shall not vary from specified thickness, and that the foundation edge is true to line with masonry not projecting over more than 1/4".
- C. Provide temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent bracing.
- D. Protect surfaces of windows, door frames, louvers and vents as well as similar finish products with painted and integral finishes from mortar droppings and stains.

3.3 INSTALLATION - GENERAL

- A. Build chases and recesses as shown or required to accommodate items specified in this and other Sections of the Specifications. Provide not less than 8 inches of masonry between chase recess and jamb of openings and between adjacent chases and recesses.
- B. Leave openings for equipment to be installed before completion of masonry. After installation of equipment, complete masonry to match construction immediately adjacent to the opening.
- C. Establish lines, levels and coursing indicated. Protect from displacement.
- D. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.
- E. Isolate masonry partitions from vertical structural framing and where indicated on the Drawings. Maintain joints free from mortar, ready to receive sealant and joint bead back-up.

July 11, 2018

- F. Provide compressible filler at tops of interior masonry partitions abutting structural above.

3.4 COURSING, BONDS AND JOINTS

- A. Coursing, joints and bond pattern: Running bond except as otherwise indicated on the Drawings.
- B. Joints:
 - 1. Exposed to view masonry: except as specified below, fill all joints with mortar, strike off flush, and when mortar is thumb print hard tool joints with a non-staining tool. Joints shall be free of drying crack.
 - a. Horizontal joints Tool joints flush.
 - b. Vertical joints (all): Tool joints flush.
 - 2. Concealed from view masonry, including masonry which will be concealed by flashings and similar materials: Fill joints with mortar and strike joints flush. Concave tool exterior joints below grade.

3.5 CONTROL JOINTS

- A. Locate control joints where shown on Drawings, at corners adjacent to openings in masonry, changes in wall height and intersections with structural walls as approved by Architect.
 - 1. Do not continue horizontal joint reinforcement through control joints.
- B. Form vertical control joints with a sheet building paper bond breaker fitted to one side of the hollow contour end of the block unit. Fill the resultant core with grout fill. Rake joint at exposed unit faces for placement of backer rod and sealant.
 - 1. Size control joints in accordance with the requirements of Section 07 92 00 - JOINT SEALANTS.

3.6 LAYING MASONRY - GENERAL

- A. Build the masonry walls and partitions in the various combinations and thickness as indicated on the Drawings.
- B. Erect all masonry work in compliance with the line and level tolerances specified herein. Hold uniform joint sizes. Correct, or replace, as directed by the Architect, non-conforming masonry work at no additional cost to the Contract.
- C. Lay out coursing before setting to minimize cutting closures or jumping bond, Avoid the use of less-than-half-size units.
- D. Laying masonry units:
 - 1. Lay masonry units in full bed of mortar, with full head joints; uniformly joint with other work.
 - 2. Lay hollow masonry units with face shell bedding on head and bed joints.
 - 3. Buttering corners of joints or excessive furrowing of mortar joints are not permitted.
 - 4. Interlock intersections and external corners.

5. Cut all exposed masonry with a motor-driven carborundum blade saw to ensure straight and clean, unchipped edges.
 - a. Lay no unit having chipped edges or face defects where such unit would be exposed to view. Remove any such unit, if installed, and replace with an undamaged unit, and bear all costs therefore.
 6. Do not spread any more mortar than can be covered before surface of mortar has begun to dry.
 7. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove entirely, clean off mortar, and reset with fresh mortar.
 8. Except for cleaning down and repointing, finish all masonry as the walls and partitions are carried up.
- E. Build-in reinforcement and anchorage items as the work progresses, grouting for secure anchorage.
1. Where steel reinforcing rods have been cast into concrete slabs, and left with upturned ends, carefully place masonry units down over the upturned ends of the rods, and fill cells of masonry units with specified grout.
 2. Embed prefabricated horizontal joint reinforcing as the work progresses, with a minimum cover of 5/8" (16 mm) on exterior face of walls and 1/2" (13 mm) at other locations. Lap units not less than 6" (152 mm) at ends. Use prefabricated L and T units to provide continuity at corners and intersections. Cut and bend units as recommended by manufacturer for continuity at returns, offsets, column fireproofing, pipe enclosures and other special conditions.
- F. Except as indicated otherwise, isolate masonry from overhead structure:
1. Isolate masonry partitions from vertical structural framing members with a control joint.
 2. Isolate top joint of masonry partitions from horizontal structural framing members and slabs, decks or blocking with compressible joint filler.
- G. Provide control joints at 30 feet on center maximum spacing, and keep clean of mortar droppings.
- H. Provide complete protection against breakage and weather damage to all masonry work, including substantial wood boxing around door jambs, over the tops of walls and wherever necessary to protect work at all stages of completion. Protect masonry when not roofed over, at all times when masons are not working on the walls. Apply tarpaulins or waterproof paper, properly weighted, or nailed, to assure their remaining in place to protect masonry from all possible hazards.
- I. Point and fill all holes and cracks in new mortar joints with additional fresh mortar; do not merely spread adjacent mortar over defect or use dead mortar droppings. Do all pointing while mortar is still soft and plastic. If hardened, chisel defect out and refill solidly with fresh additional mortar, and tool or rake joints as specified herein.
- J. Protect all masonry from rain prior to, and during the installation thereof. If the temperature is in excess of 80 degrees Fahrenheit at time of installation, lightly moisten contact surfaces of masonry units by brushing with water.

July 11, 2018

- K. Cold/Hot Weather Procedures: No masonry work shall be laid in temperatures below 40 degrees Fahrenheit without the submittal to and review by the Architect of cold weather procedures.
1. In ambient temperatures below 40 degrees Fahrenheit make provisions to adequately protect the masonry materials and the finished work from frost by heating of masonry materials, enclosing the work or heating the enclosed spaces.
 2. No frozen work shall be built upon nor shall anti-freeze admixtures be permitted in the mortar mix.
 3. Any completed work found to be affected by frost shall be taken down and rebuilt at no additional expense to the Owner.
 4. This project will have an waterproofing material applied to CMU as specified under Section 07 14 16 - COLD FLUID APPLIED WATERPROOFING AND SECTION 071353 - ELASTOMERIC SHEET WATERPROOFING. Special attention and care must be taken to provide a smooth, filled surface to receive the membrane. The care is necessary to insure the design performance of the selected materials.
 5. Concrete masonry unit (CMU) wall shall be prepared as follows to accept the air & vapor barrier:
 - a. Surfaces shall be free of contaminants such as grease, oil and wax on surfaces to receive membrane
 - b. The CMU surfaces shall be free from projections.
 - c. Strike all mortar joints full and flush to the face of the concrete block.
 - d. Fill all voids and holes greater than 1/2-inch across at any point with mortar, sealant or other approved fill material.
 - e. Fill all cracks, gaps and joints exceeding 1/4-inch width with mortar, sealant or other approved fill material.
 - f. Surface irregularities exceeding 1/4-inch in height or sharp to touch shall be ground flush or made smooth.
 - g. Fill around all penetrations with mortar, sealant or other approved fill material and strike flush.
 - h. If the surfaces cannot be made smooth to the satisfaction of the Architect, it will be the responsibility of the trade to alternatively apply a parge coat (one part cement to three parts sand) over the entire surface to receive Air & Vapor Barrier Membrane
 - i. Remove mortar droppings on brick ties, shelf angles, brick shelves or other horizontal obstructions.

3.7 ENGINEERED MASONRY

- A. Lay masonry units with core cells vertically aligned and clear of mortar and unobstructed.
- B. Place mortar in masonry unit bed joints back 1/4 inch from edge of unit grout spaces, bevel back and upward. Permit mortar to cure 7 calendar days before placing grout.

July 11, 2018

- C. Refer to the Drawings for locations where vertical steel reinforcing rods will be required in masonry walls. Reinforce masonry unit cores with reinforcement bars and grout.
- D. Retain vertical reinforcement in position at top and bottom of cells and at intervals not exceeding 192 bar diameters. Splice reinforcement in accordance with Division 3 - Concrete.
- E. Wet masonry unit surfaces in contact with grout just prior to grout placement.
- F. Grout spaces less than 2 inches in width with fine grout using low lift grouting techniques. Grout spaces 2 inches or greater in width with course grout using high or low grouting techniques.
- G. When grouting is stopped for more than one hour, terminate grout 1-1/2 inch below top of upper masonry unit to form a positive key for subsequent grout placement.
- H. Low lift grouting: Place first lift of grout to a height of three concrete masonry unit courses, and rod for grout consolidation. Place subsequent lifts in 8 inch increments and rod for grout consolidation.
- I. High lift grouting:
 - 1. Provide cleanout opening no less than 4 inches high at the bottom of each cell to be grouted by cutting one face shell of masonry unit.
 - 2. In double wythe walls, omit every second masonry unit in one of the wythes for clean out and cell inspection purposes.
 - 3. In double wythe walls, construct vertical grout barriers or dams between masonry wythes, with masonry units ever 30 feet maximum.
 - 4. Clean out masonry cells [and cavities] with [high pressure water spray. Permit complete water drainage.] [compressed air, remove debris.]
 - 5. Request inspection of the cells and cavities. Allow [3 working days] [24 hours] notice.
 - 6. After cleaning and cell inspection, seal openings with masonry units.
 - 7. Pump grout into spaces. Maintain water content in grout to intended slump without aggregate segregation..
 - 8. Limit grout lift to 60 inches and rod for consolidation [mechanically vibrate]. Wait between 30 and 60 minutes before placing next lift.

3.8 BUILDING-IN WORK

- A. As work progresses install built-in metal door and glazed frames, fabricated metal frames, window frames, wood nailing strips, fireplace accessories, anchor bolts, plates and other items to be built-in the work.
- B. Install built-in items plumb and level; take care not to distort alignment of such items.
- C. Bed anchors of metal frames in adjacent mortar joints. Fill frame voids solid with grout except where joints are indicated to receive caulking and sealant. Fill adjacent masonry cores with grout minimum 12 inches from framed openings.
 - 1. Rake joints to receive sealant to a uniform depth of 3/4 inch for installation of caulking and sealant.
- D. Do not build-in organic materials subject to deterioration.

July 11, 2018

3.9 BUILDING-IN LINTELS

- A. Install loose lintels over all openings, whether or not scheduled. Install reinforced unit masonry lintels over openings where steel or precast concrete lintels are not scheduled.
 - 1. Openings up to 42 inches wide: Place two N^o4 reinforcing bars 1 inch from bottom web.
 - 2. Openings from 43 inches wide up to 78 inches wide: Place two N^o5 reinforcing bars 1 inch from bottom web.
 - 3. Openings over 79 inches wide: Reinforce as detailed in Drawings, consult Architect/Engineer if not detailed.
 - 4. Do not splice reinforcing bars.
 - 5. Support and secure reinforcing bars from displacement. Maintain position with 1/2 inch of dimensioned position.
 - 6. Place and consolidate grout fill without displacing reinforcing.
 - 7. Allow masonry lintels to attain specified strength before removing temporary supports.

- B. Where not detailed otherwise, maintain the following minimum bearings for lintels on each side of opening:
 - 1. 6 inches bearing on concrete.
 - 2. 3 inches bearing on steel.
 - 3. 8 inches bearing on masonry.

3.10 REINFORCEMENT AND ANCHORAGE

- A. Reinforce horizontal joints with continuous masonry joint reinforcement, spaced 16 inches vertically commencing one course above supporting concrete slab.
- B. Place masonry joint reinforcement in first and second horizontal joint above and below openings. Extend 16 inches each side of opening.
- C. Place joint reinforcement in first and second joint below top of walls.
- D. Lap joint reinforcement ends minimum 6 inches .
- E. Install preformed units (or optional field-formed units) at corners, reveals, and offsets in exterior masonry, at intersections of all masonry walls and partitions, and wherever walls and partitions change directions.
- F. Do not bridge control and expansion joints in the wall system.
- G. Embed anchors in concrete. Attach to structural steel members. Embed anchorages in every second block.

3.11 FIELD QUALITY CONTROL

- A. Field inspection will be performed under the provisions of Division 1 – GENERAL REQUIREMENTS (Section 014500 - QUALITY CONTROL, or Section 014529 – TESTING LABORATORY SERVICES, as applicable).
- B. Testing frequency: Tests and evaluations listed in this article shall be performed during construction for each 5000 square feet of wall area or portion thereof.

July 11, 2018

- C. Prism Test Method: For each type of wall construction indicated on Drawings, masonry prisms will be tested per ASTM E 447, Method B: and as follows:
 - 1. Prepare one set of prisms for testing at 7 days and one set for testing at 28 days.
- D. Evaluation of Quality Control tests: In absence of other indications of noncompliance with requirements, masonry will be considered satisfactory if results from source quality control tests comply with minimum requirements indicated.

3.12 PROTECTION OF WORK

- A. Loading: Do not apply loading for at least 12 hours after building masonry walls and partitions. Do not apply concentrated loads for at least 3 days after building masonry columns, walls or partitions.
- B. Protection of Masonry: During erection, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
 - 1. Extend cover a minimum of 24 inches down both sides and hold cover securely in place.
 - 2. Where one wythe of multi-wythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches down face next to un-constructed wythe and hold cover in place.
- C. Stain prevention: Provide protection and prevent grout, mortar, and soil from staining the face of exposed masonry and building finishes. Protect base of walls from rain-splashed mud and mortar splatter.
 - 1. Remove immediately all grout, mortar, and soil that come in contact with such masonry.

3.13 TOLERANCES

- A. Maximum variation from true surface level for exposed to view walls and partitions:
 - 1. Unit-to-unit tolerance: 1/16 inch.
 - 2. Surface, overall tolerance: 1/4 inch in 10 feet in any direction and 1/2 inch in 20 feet or more.
 - a. Where both faces of single wythe wall or partition will be exposed to view, request and obtain decision from the Architect as to which face will be required to conform to the specified surface level tolerance.
- B. Maximum variation from plumb: For lines and surfaces of walls do not exceed 1/4 inch in 10 feet, 3/8 inch in any story up to 20 feet maximum. At expansion joints and other conspicuous lines, do not exceed 1/4 inch in 20 feet.
- C. Maximum variation from level: For lines of sills, tops of walls and other conspicuous lines, do not exceed 1/8 inch in 3 feet, or 1/4 inch in 10 feet and 1/2 inch in 30 feet.
- D. Maximum variation of linear building line: For position shown in plan relating to columns, walls and partitions, do not exceed 1/2 inch in 20 feet or 3/4 inch in 40 feet.
- E. Maximum variation in specified height: 1/2 inch per story.
- F. Maximum variation of joint thickness: 1/8 inch in 3 feet.

- G. Maximum horizontally projected unsupported masonry unit: 1-1/8 inches

3.14 CLEANING

- A. Comply with requirements of Section 017419 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL for handling and disposition of all construction and demolition waste.
- B. Progress Cleaning:
 - 1. General: Maintain site free of waste materials, debris, and rubbish resulting from the work of this Section.
 - a. Remove from work areas surplus and waste materials resulting from the work of this Section. Remove on a continual on-going basis through-out the term of construction.
 - 2. During the progress of the work, keep the exposed surfaces of masonry clean at all times, and protected against damage. As each segment of the masonry is erected, dry-brush the surfaces free from mortar spots and droppings.
- C. Prior to performing the final cleaning work, examine all face joints in exposed masonry to locate cracks, holes or other defects in the mortar; and point up all such defects and fill with mortar as specified herein. Where necessary, in the opinion of the Architect, cut out defective joints in masonry and replace with new materials, exercising extreme care to match original work.
- D. At a time approved by the Architect, perform final cleaning operations on all masonry as specified herein .
 - 1. Perform the final cleaning work only when the ambient temperature is above 40 degrees Fahrenheit, and rising.
 - 2. Do not use wire brushes or other abrasive tools in the cleaning operations.
 - 3. Perform final cleaning operations from the top down. If masonry cleaning work is performed after windows, doors, frames, and other work has been installed, provide complete protection for said items; be fully responsible for any damage due to the cleaning operations.
 - 4. Remove large mortar particles by hand with wooden paddles and non-metallic scrape hoes or chisels.
 - 5. Perform final cleaning of masonry units by scrubbing with stiff bristle fiber brushes and clear water, changing the water frequently.
- E. Provide suitable protective coverings for all other surfaces and materials during the final cleaning procedures, and bear full responsibility for correcting any damage caused by these operations, to the satisfaction of the Architect.

End of Section

Section 05 50 00
METAL FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

- A. General: The work of this Section consists of miscellaneous metals, and ornamental iron where shown on the Drawings, as specified herein, and as required for a complete and proper installation.
- B. Furnish and install:
 - 1. Interior metal railings with brackets.
 - 2. Exterior railings, hot-dipped galvanized and shop finished.
 - 3. Elevator pit ladders.
 - 4. Elevator sill support angles.
 - 5. Restraining angles at top of masonry walls.
- C. Furnish the following items for installation under related sections:
 - 1. Loose steel lintels at door, window, ductwork and similar openings in interior masonry partitions; installed under Section 04 20 00 - UNIT MASONRY.
 - 2. Hot dipped galvanized loose lintels at door, louver, window and similar openings in masonry partitions; installed under Section 04 20 00 - UNIT MASONRY.
- D. Perform all shop-painting for all surfaces of exposed to view galvanized and non-galvanized metals, and post-erection touch-up of shop prime coat, using the same material as shop-prime coating.
- E. No attempt is made in this Section to list all elements of miscellaneous metal required on this project or to describe how each element and component will be installed. It is the responsibility of the subcontractor to determine for itself the scope and nature of the work required for a complete installation from the information provided herein and in the Drawings.

1.2 RELATED REQUIREMENTS

- A. Section 03 30 00 - CAST-IN-PLACE CONCRETE: Installation of anchors into concrete, pouring concrete stair treads and landings.
- B. Section 04 20 00 - UNIT MASONRY:
 - 1. Installation of loose lintels furnished by this Section 05 50 00.
- C. Section 06 10 00 - ROUGH CARPENTRY: Wood framing, blocking, subflooring and underlayment.
- D. Section 09 91 00 - PAINTING: Applied finish coatings other than those specified herein.
- E. Section 14 22 00 - COMPACT TRACTION ELEVATORS:
 - 1. Elevator guide rails

July 11, 2018

2. Hoist way entrance door sills.

1.3 REFERENCES

- A. Referenced Standards: Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. The standards referenced herein are included to establish recognized minimum quality only. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern. Equivalent quality and testing standards will be acceptable, subject to their timely submission, review and acceptance by the Architect.
 1. ASTM A 36 - Structural Steel.
 2. ASTM A 53 – Pipe, Steel, Black and Hot-Dipped, Zinc-coated, Welded and Seamless Steel Pipe.
 3. ASTM A 108 - Standard Specification for Steel Bar, Carbon and Alloy, Cold Finished.
 4. ASTM A 123 - Zinc Coatings on Products Fabricated From Rolled, Pressed and Forged Steel Shapes, Plates, Bars, and Strip.
 5. ASTM A 153 - Zinc-Coating on Iron and Steel Hardware.
 6. ASTM A 283 - Carbon Steel Plates, Shapes, and Bars.
 7. ASTM A 307 - Carbon Steel Externally Threaded Standard Fasteners.
 8. ASTM A 325 - Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
 9. ASTM A 361 - Zinc Coated (Galvanized) Iron or Steel Roofing sheets.
 10. ASTM A 385 – Providing High Quality Zinc Coatings.
 11. ASTM A 380 – Standard Practice for Cleaning, Descaling and Passivation of Stainless Steel Parts, Equipment and Systems.
 12. ASTM A 386 - Zinc Coating on Assembled Steel Products.
 13. ASTM A 446 - Zinc Coated (Galvanized) Steel Sheets of Structural Quality, Coils and Cut Lengths.
 14. ASTM A 501 - Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.
 15. ASTM A 525 - Specification for Sheet Steel, Zinc Coated (Galvanized).
 16. ASTM A 780 – Repair of Hot-Dip Galvanizing.
 17. ASTM A1011/A1011M - Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength.
 18. ASTM B117 Standard Practice for Operating Salt Spray (Fog) Apparatus.
 19. ASTM A 575 Standard Specification for Steel Bars, Carbon, Merchant Quality, M-Grades.
 20. ASTM A576 Standard Specification for Steel Bars, Carbon, Hot-Wrought, Special Quality.
 21. ASTM A 653 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

July 11, 2018

22. AGAI - Inspection Manual for Hot-Dipped Galvanized Products.
23. AISC - Code of Standard Practice for Steel Buildings and Bridges.
24. AISC - Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings.
25. AWS - Standard Code for Arc and Gas Welding in Building Construction.
26. MIL-P-21035B - Paint High Zinc Dust Content, Galvanizing Repair (Metric) (superseding DOD-P-21035A)
27. SSPC referenced standards.
28. NAAMM publication AMP 500 – Metal Finishes Manual
29. NAAMM publication AMP 510 – Metal Stairs Manual.
30. NAAMM publication AMP 521 – Pipe Railing Manual
31. NAAMM publication AMP 555 – Code of Standard Practice for The Architectural Metal Industry.
32. SSPC standards referenced herein, including:
 - a. SSPC-SP1, Surface Preparation – Solvent Cleaning,
 - b. SSPC-SP2, Surface Preparation – Hand Tool Cleaning.
 - c. SSPC-SP3, Surface Preparation – Power Tool Cleaning
 - d. SSPC-SP8, Surface Preparation - Pickling.
 - e. SSPC-Paint 20, Zinc-Rich Coating (Type 1) Inorganic and (Type II) Organic.
 - f. SSPC-Paint 29, Zinc Dust Sacrificial Primer Performance.

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 1. Coordinate work of this subcontract with that of other trades, affecting or affected by this work, and cooperate with the other trades as is necessary to assure the steady progress of work.
 2. Be responsible for establishing locations and levels for all work of this Section, except such parts as may be delivered to others and set by them. In such cases assist them in properly locating said parts.
- B. Sequencing:
 1. Field Measurements
 - a. Take field measurements before preparation of shop drawings and fabrication, where possible, to ensure proper fitting of Work.
 - b. Allow for adjustments within specified tolerances wherever taking of field measurements before fabrication might delay Work.
- C. Scheduling:
 1. Coordinate the work of this Section with the respective trades responsible for installing inserts and anchorages furnished by this Section; make arrangements for delivery, receipt and installation of inserts and anchorages to prevent delay of the Work.

1.5 SUBMITTALS

- A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
1. Product Data: Manufacturer's complete product data and specifications for all prefabricated items, shop primer paints, liquid zinc coating, and hydraulic cements, to be furnished hereunder.
 - a. For epoxy anchoring systems: Furnish ICC-ES Code approvals and performance data that includes recommended loading for each application.
 2. Shop Drawings, bearing registration stamp of a Professional Structural Engineer registered in Commonwealth of Massachusetts.
 - a. General requirements:
 - 1) Include large scale details of items of all metal fabrications to be furnished hereunder, showing proposed methods of anchorage to surrounding structure and conditions.
 - 2) Indicate on the shop drawings all erection marks for various places of miscellaneous metals, and ensure that the actual field pieces bear corresponding marks.
 - 3) Indicate shop built components, and field-built components.
 - 4) Indicate and detail all field installation connections.
 - 5) Indicate weld types and length.
 - 6) Indicate blocking locations.
 - b. Include large scale details of railings.
 3. Selection Samples:
 - a. Sample card indicating Manufacturer's full range of colors of shop applied finishes available for selection by Architect.
 4. Verification Samples: Accepted samples will be used to establish the quality standard for fabrication, workmanship and finish.
 - a. Factory/shop finishes: 3 inch by 6 inch samples of factory-applied coatings and colors proposed for use for approval prior to coating application.
 - b. Handrail, quality assurance sample: Fabricate a sample showing a typical handrail section demonstrating component connections. Sample section shall be minimum 18 inches in horizontal length and 12 inches in height and include a corner post. Provide a shop primed finish.
 - c. Provide minimum 24 by 24 inch (or equivalent for shapes) of fabricated and finished ornamental metal components, demonstrating the quality of fabrication work, and finish.
 5. Certificates:
 - a. Certificate of Compliance from Galvanizer: Submit notarized Certificate of Compliance with application for payment for galvanizing, signed by galvanizer, indicating compliance with requirements of specifications. Include scope of services provided, and quantity and itemized description of items processed.
 - b. Welders certificates as specified under Article entitled "QUALITY ASSURANCE".

6. Delegated Design Submittals: Provide calculations for loading and stresses for the work of this section, bearing the Professional Structural Engineer's seal. Show how design load requirements and other performance requirements as required by the Massachusetts State Building Code have been satisfied.
 - a. Work scope requiring loading and stress calculations includes, but is not limited to the following:
 - 1) Railings.
 - 2) Metal fabrications supporting work of other trades.
 - 3) Seismic restraints.
- B. Closeout Submittals: Submit the following under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS.
 1. Special Inspections: Submit prior to request for Certificate of Occupancy, to both Architect and local Building Official having jurisdiction, the following:
 - a. All certifications, reports and programs required by Chapter 17 of the Massachusetts State Building code for work engineered by Contractor's Professional Engineer under the requirements of this Section.

1.6 QUALITY ASSURANCE

- A. General: Notify the Architect where conflicts apply between referenced standards and existing materials, and existing methods of construction.
 1. Galvanizer's tagging: The galvanizer shall mark all lots of material with a clearly visible stamp or tag indicating the name of the galvanizer, the weight of the zinc coating, and the applicable ASTM Specification Numbers.
- B. Exposed Fabricated Steel Elements including stairs, railings, ornamental fabrications and exposed to view fabrications shall be fabricated and finished as Architectural Exposed Structural Steel (AESS) meeting tolerances and fabrication requirements as specified herein.
- C. Qualifications:
 1. Fabricator/Installer: Minimum of 5 years documented experience demonstrating previously successful work of the type specified herein, and approved by product manufacturer.
 2. Welders: Utilize only qualified welders employed on the Work. Submit verification that Welder's are AWS D1.1 and D1.4 qualified within the previous 12 months.
 3. Licensed Professionals: Provide the services of a Professional Structural Engineer, registered in the Commonwealth of Massachusetts to design and certify that the work of this section meets or exceeds the performance requirements specified in this section and as required by Massachusetts State Building Code.
 - a. Prepare Shop Drawings for under direct supervision of a same Engineer experienced in design of this work.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Delivery and Acceptance Requirements:

July 11, 2018

1. Do not order or deliver any materials until all submittals, required in the listed Specification Sections included as part of this Subcontract, have been received and approved by the Architect.
- B. Storage and Handling Requirements:
1. Handle and store materials under cover in a manner to prevent defacement, deformation, or other damage to the materials and to shop finishes, and to prevent the accumulation of foreign matter on the metal work. All such work shall be repaired and cleaned prior to erection.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. General: All materials shall be new stock, free from defects impairing strength, durability or appearance, and of best commercial quality for each intended purpose. Unless specifically called for otherwise, work shall be fabricated from the following:
1. Carbon Steel:
 - a. Steel shapes, plates and bars: ASTM Designation A 36.
 - b. Steel pipe: ASTM A53, grade A, seamless pipe, black finish unless otherwise noted.
 - c. Structural steel tubing, square and rectangular shapes: ASTM A500, Grade B.
 - d. Steel tubular shapes: ASTM A 501.
 - e. Steel plates to be bent or cold-formed: ASTM A283, grade C.
 - f. Steel bars and bar-size shapes: ASTM A36.
 - g. Cold-finished steel bars: ASTM A108.
 - h. Galvanized carbon steel sheets: ASTM A526, with G90 zinc coating in accordance with ASTM A525.
 - B. Steel materials: to be hot dip-galvanized: Provide steel chemically suitable for metal coatings complying with the following requirements: Carbon below 0.25 percent, silicon below 0.24 percent, phosphorous below 0.05 percent, and manganese below 1.35 percent. Notify galvanizer if steel does not comply with these requirements to determine suitability for processing.
 - C. Metal surfaces, general: For metal fabrications exposed to view upon completion of the Work, provide materials selected for their surface flatness, smoothness and freedom from surface blemishes. Do not use materials whose exposed surfaces exhibit pitting, seam marks, roller marks, rolled trade names, roughness, and, for steel sheet, variations in flatness exceeding those permitted by reference standards for stretcher-leveled sheet.
 - D. Welding rods: AWS E70XX grade, or select in accordance with AWS specifications for the metal alloy to be welded and in accordance with the recommendation of the welding rod manufacturer.
 1. Where stainless steel is welded to mild steel, select rods to minimize dilution effects on the stainless steel component.

2.2 FASTENERS

- A. General: Provide all fasteners and attachments as required for work specified herein and as indicated on the Drawings.
 - 1. In general,
 - a. Provide all fasteners and attachments of the same material and finish as the metal to which it is applied unless otherwise noted.
 - 1) Provide Type 304 stainless-steel fasteners for exterior use.
 - 2) Provide Type 304 stainless-steel fasteners for fastening aluminum.
- B. Steel Bolts, Nuts and Washers: ASTM A307, galvanized to ASTM A153 for galvanized components.
- C. Anchor Bolts: ASTM F 1554, Grade 36.
 - 1. Provide hot-dip or mechanically deposited, zinc-coated anchor bolts where item being fastened is indicated to be galvanized.
- D. Eyebolts: ASTM A 489.
- E. Machine Screws: ASME B18.6.3.
- F. Lag Bolts: ASME B18.2.1.
- G. Wood Screws: Flat head, ASME B18.6.1.
- H. Plain Washers: Round, ASME B18.22.1.
- I. Lock Washers: Helical, spring type, ASME B18.21.1

2.3 ACCESSORIES

- A. Adhesive for attaching anchors and for direct pinning: high-modulus, high strength, moisture tolerant, epoxy adhesive, two-component 100 percent solids, epoxy resin complying with ASTM C 881.
 - 1. Minimum performance properties (as cured at 70 degrees F. and 50 percent relative humidity):
 - a. Minimum Compressive Strength, tested per ASTM D-695:
 - 1) at 3 days: 11300 psi (31.0 MPa).
 - 2) at 7 days: 11800 psi (44.8 MPa).
 - 3) at 28 days: 12200 psi (58.6 MPa).
 - b. Shear Strength, tested per ASTM D-732 at 14 days: 6200 psi (43 MPa)
 - c. Minimum Flexural Strength tested per ASTM D-790 at 14 days: 10700 psi (74 MPa).
 - d. Minimum Bond Strength tested per ASTM C-882 at 14 days:
 - 1) Plastic Concrete to Hardened Concrete 2200 psi (13.8 Mpa).
 - 2) Plastic Concrete to Steel 2000 psi (13.8Mpa).
 - e. Maximum Water Absorption, tested per ASTM D-570: 24 hour 0.27%
 - f. Minimum Tensile properties tested per ASTM D-638: Tensile Strength 6900 psi (48 Mpa).

2. Products which may be considered as equal include the following, or approved equal:
 - a. Sika Corporation, Lyndhurst NJ., product: "Sikadur 32 Hi-Mod Gel.
 - b. Simpson Strong Tie, Pleasanton, CA., product "SET High Strength Epoxy".
 - c. Symons Corporation, Des Plaines, IL., product "Rescon Gel anchor 304".

- B. Grout: Ready mixed, non-metallic high-strength controlled expansion grout of flowable consistency, conforming to ASTM C 1107 with minimum compressive strength of 8,000 pounds per square inch (55.2 MPa) at 28 days.
 1. Products which may be considered as equal include the following, or approved equal:
 - a. Five Star Products, Inc., Fairfield CT, product "Five Star Grout."
 - b. L&M Construction Chemicals, Omaha NE, Product: "Crystex."
 - c. BASF Construction Chemicals, Cleveland, OH., product "Masterflow 713".
 - d. Sika Corporation, Lyndhurst, NJ., product "SikaGrout 212".
 - e. ChemMasters, Madison, OH., product "Conset".

- C. Metal paste filler: 2 component epoxy, high strength, structural adhesive putty:
 1. Products which may be considered as equal include the following, or approved equal:
 - a. Abatron, Inc. Gilberts IL, product: "Ferrobond-P".
 - b. Dynatron/Bondo Corp., Atlanta, GA, product: "Bondo Plastic Filler".
 - c. U.S. Chemical & Plastics Company., Massillon OH, product "Metal filled epoxy".

- D. Primer for non-galvanized steel surfaces, modified alkyd rust-inhibitive, high solids primer:
 1. Products which may be considered as equal include the following, or approved equal:
 - a. Benjamin Moore product: "Metal Primer KP14-70", Gray Primer.
 - b. Rust-Oleum: 6100, Gray Primer.
 - c. Sherwin Williams: Kem Flash 500 Primer, Gray Primer E61A750.
 - d. Tnemec: V10-1009 Gray Primer.

2.4 FABRICATION - GENERAL

- A. Metal surfaces shall be clean and free from mill scale, flake, rust and rust pitting; well formed and finished to shape and size, true to details with straight, sharp lines, and angles and smooth surfaces. Curved work shall be to true radii. Exposed sheared edges shall be eased.

- B. Shop fabricate items wherever practicable, accurately fitting all parts and making all joints tight. Do not fabricate materials until all specified submittals have been submitted to, and approved by, the Architect.

July 11, 2018

- C. Do all cutting, punching, drilling, and tapping required for attachment of anchor bolts and other hardware and for attachment of work by other trades. All such work shall be done prior to hot-dip galvanizing of the various components.
- D. Grind all edges of bars and plates completely free from nicks and machine marks, prior to galvanizing and/or shop priming.
- E. Grind all exposed-to-view welds completely smooth and flush to the surface plane of the base metals. Perform welding work prior to galvanizing in all cases, except where field welding is necessary, in which case, completely coat all such welds with two coats of specified liquid zinc coating, after performing grinding operations.
 - 1. Finish welds on exposed to view components to comply with NOMMA's "Voluntary Joint Finish Standards" for Type 1 welds: no evidence of a welded joint.
- F. Use screws and bolts only where welding cannot be performed, of sufficient size to ensure against loosening from normal usage of miscellaneous metal items furnished hereunder.
 - 1. Countersink all screw heads and bolt heads as far as practicable. Use not less than two screw, bolts, or other anchorage items, at each connection point.
 - 2. Draw up all threaded connections tightly, after buttering same with pipe joint compound, to exclude water.
- G. Provision for Thermal Movement: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.
 - 1. Design, fabricate and install for temperature change range of 120 degrees F, ambient temperature and 180 degrees F, material surfaces.
- H. Carefully coordinate the installation of metal fabrications with the work of trades responsible for the installation of interfacing work, and for the installation of work into the various assemblies furnished hereunder, and permit the installation of the related materials to be made at the appropriate times.
- I. Fit and assemble metal fabrications in largest practical sections for delivery to site, ready for installation.
 - 1. Galvanized assemblies: Where size of assembly is too large for galvanizing kettle, galvanize components prior to fabrication and assemble after galvanizing.

2.5 FABRICATION - RAILINGS (HANDRAILS/GUARDRAILS)

- A. Refer to the Drawings for location and details of steel railings to be furnished and installed hereunder.
 - 1. Verify heights shown in Drawings comply with referenced codes and regulations.
 - 2. Railings: Design, fabricate and install all railings in a manner which will ensure the railings will be capable of withstanding loads as follows and as required under Section 1607 of 2015 International Building Code with Massachusetts Building Code, Ninth Edition amendments.

- a. Resist a load of 50 pounds per linear foot (0.73 kN/m) applied in any direction at the top and to transfer load through railing supports to structure.
 - b. Resist a single concentrated load of 200 pounds (0.89kN) applied in any direction at any point along the top, and to transfer load through railing supports to structure. Concentrated loading requirements are not concurrent with other loading requirements.
 - c. Intermediate rails, balusters and panel fillers shall resist a horizontally applied load of 200 pounds (0.89 kN) on an area equal to 1 square foot (.093m²), including openings and space between rails. Reactions due to this loading are not required to be superimposed with loadings specified for top rail.
- B. Fabrication, Railings: Fabricate to comply with requirements indicated for design, dimensions, details, finish, and member sizes, including wall thickness of tube, post spacings, and anchorage, but not less than that needed to withstand indicated loads and deflection criteria. Indicate on shop drawings sizes of all members, gages and configurations of handrails, and guardrails.
1. Fabricate railings with welded connections. Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.
 - a. Finish welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Type 1 welds: no evidence of a welded joint.
 2. Form changes in direction of railings as indicated on drawings, with radius bends of radius indicated. Form simple and compound curves by bending members in jigs to produce uniform curvature for each repetitive configuration required; maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.
 3. Close exposed ends of railing members with prefabricated end fittings.
 4. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated. Close ends of returns unless clearance between end of rail and wall is 1/4 inch (6 mm) or less.
 5. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, end closures, flanges, miscellaneous fittings, and anchors for interconnecting components and for attaching to other work. Furnish inserts and other anchorage devices for connecting to concrete or masonry work.
 - a. Connect posts to stair framing by direct welding unless otherwise indicated.

2.6 FINISHES - HOT-DIP GALVANIZING

- A. Surface preparation prior to galvanizing: Pickle steel prior to galvanizing in conformance with SSPC-SP8. Remove all rust, dirt, weld flux, weld spatter, and other foreign matter.
- B. Hot-Dip Galvanizing: For steel exposed to the elements, weather or corrosive environments and other steel indicated to be galvanized, provide coating for iron and steel fabrications applied by the hot-dip process.
 1. Basis-of-Design: "Duncan Galvanizing, Everett, MA., product "Duragalv."

July 11, 2018

2. Comply with ASTM A 123 for fabricated products and ASTM A 153 for bolts, nuts, washers, and other rough hardware. Provide thickness of galvanizing specified in referenced standards.
3. Wherever possible, perform galvanizing after assembly of items.
4. Galvanized items shall be straightened to remove all warpage and distortion caused by the galvanization process.
5. Fill vent holes after galvanizing (if applicable), and grind smooth.
6. Touch-up all breaks on hot-dip surfaces caused by cutting, welding, drilling or undue abrasion with liquid zinc coating as specified herein above. Apply liquid zinc by brush or spray on all damaged areas in two coats to a total dry film thickness of not less than 3 mils. Apply first coat within two hours after damage to hot-dip film to prevent undue oxidation of exposed surface. On all welds remove weld spatter by power wire brushing or equivalent before applying liquid zinc coating. Repair material should extend at least 3 inches beyond all edges of the damaged galvanized area as possible to assure continuity of galvanic protection.
7. Touch-up of galvanized surfaces with aerosol spray, silver paint, bright paint, brite paint, or aluminum paints is not acceptable.

2.7 FINISHES - SHOP APPLIED COATINGS

- A. Schedule: Shop applied coatings as indicated on Drawings, and as additionally specified and scheduled in this Section.
- B. For non-galvanized steel surfaces:
 1. Surface preparation prior to priming: Thoroughly clean all steel of all loose mill scale by power wire brushing or sandblasting. Remove all rust, dirt, weld flux, weld spatter, and other foreign matter by wire-brushing or scraping (power wire-brushing, if necessary). Grind smooth any sharp projections.
 2. Shop apply specified primers thoroughly and evenly on the surfaces and worked into the joints and other open areas on the surfaces. Surfaces inaccessible after assembly shall be given two coats. Dry film thickness of primer shall be not less than 2.4 mils per coat.
- C. For exterior railings having hot-dipped galvanized steel treatment and shop applied coating:
 1. Touch-up all breaks on hot-dip surfaces caused by cutting, welding, drilling or undue abrasion with liquid zinc coating as specified above under the Article entitled "Hot Dip Galvanizing", herein above.
 2. Finish: Provide factory-applied architectural coating over hot-dip galvanized steel matching approved samples.
 - a. Basis-of-Design: Duncan Galvanizing, Everett, MA., product "Colorgalv 10".
 - b. Primer coat shall be factory-applied. Apply primer within 12 hours after galvanizing and within 3 hours of surface preparation at the same facility where the galvanizing is done in a controlled environment meeting applicable environmental regulations and as recommended by the primer coating manufacturer. Primer must meet or exceed the criteria for the following categories as stipulated by the coatings manufacturer:

- 1) Abrasion Resistance: ASTM D4060 (CS17 Wheel, 1,000 grams load) 1kg load, 200 mg loss.
 - 2) Adhesion: ASTM D4541, 1050 psi.
 - 3) Corrosion Weathering: ASTM D5894, 13 cycles, 4,368 hours; rating 10 per ASTM D714 for blistering and rating 7 per ASTM D610 for rusting.
 - 4) Direct Impact Resistance: ASTM D2794, 160 in. lbs.
 - 5) Flexibility: Method: ASTM D522, 180 degree bend, 1 inch mandrel, passes.
 - 6) Pencil Hardness: ASTM D3363, 3B.
 - 7) Moisture Condensation Resistance: ASTM D4585, 100 degrees F, 2000 hours; passes, no cracking or delamination.
 - 8) Dry Heat Resistance: Method: ASTM D2485, 250 degrees F.
- c. Finish coat shall be factory-applied high performance architectural finish. Apply finish coating at the galvanizer's plant, in a controlled environment meeting applicable environmental regulations and as recommended by the finish coating manufacturer. Finish must meet or exceed the criteria for the following categories as stipulated by the coatings manufacturer:
- 1) Abrasion Resistance: ASTM D 4060, CS17 Wheel, 1,000 cycles 1kg load, 87.1 mg loss.
 - 2) Adhesion: ASTM D4541, 1050 psi.
 - 3) Direct Impact Resistance: ASTM D2794, greater than 28 in. pounds.
 - 4) Indirect Impact Resistance: ASTM D2794, 12-14 in. pounds.
 - 5) Dry Heat Resistance: ASTM D2485, 200 degrees F.
 - 6) Salt Fog Resistance: ASTM B117 9,000 hours, rating 10 per ASTM D714 for blistering.
 - 7) Flexibility: ASTM D522, 180 degree bend, 1/8 inch mandrel, passes.
 - 8) Pencil Hardness: ASTM D3363, 2H.
 - 9) Moisture Condensation Resistance: ASTM D4585, 100 degrees F, 1000 hours, no blistering or delamination.
 - 10) Xenon Arc Test: ASTM D 4798, pass 300 hours.
- d. Coatings shall be certified VOC compliant and conform to applicable regulations and EPA standards. Apply the galvanizing, primer and coating within the same facility and provide single-source responsibility for galvanizing, priming and finish coating. Blast cleaning of the galvanized surface is not acceptable.
3. Engage the services of a galvanizing facility which will assume single-source responsibility for galvanizing and finish coating.
- a. Touch-up finish in conformance with manufacturer's recommendations. Provide touch-up such that repair is not visible from a distance of 6 feet.
- D. Field touch-up: Shall be the responsibility of the installing contractor and shall include the filling, and touch-up of exposed job made bolt or screw holes, refinishing of raw surfaces resulting from job fitting, repair of job inflicted scratches and marks, and final cleaning up of the finished surfaces.

1. Touch-up finishes shall be fully compatible with, and exactly match shop applied finish, color, texture and sheen.

PART 3 - EXECUTION

3.1 ERECTION - GENERAL

- A. General: Accurately set all work to established lines and elevations, and rigidly fasten in place with suitable attachments to the construction of the building. At the completion of the work, check all work, re-adjust as required, and leave in perfect condition. Grind all exposed to view welds smooth to the touch.
- B. Setting bearing and leveling plates:
 1. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.
 2. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with grout.
 - a. Use nonshrink grout, either metallic or nonmetallic, in concealed locations where not exposed to moisture; use nonshrink, nonmetallic grout in exposed locations, unless otherwise indicated.
 - b. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.
- C. Miscellaneous framing and supports: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and additional requirements indicated on Shop Drawings.
 1. Anchor supports for operable partitions, and similar products, securely to and rigidly braced to building structure.

3.2 FIELD WELDING

- A. Field weld components indicated on approved shop drawings in accordance with AWS D1.1. Weld profile, quality, and finish shall be consistent with approved samples and mock-ups.
 1. Welds ground smooth: . For groove welds, the weld shall be made flush to the surfaces of each side and be within + 1/16", -0" of plate thickness.
 2. Contouring and blending of welds: Where fillet welds are indicated to be ground contoured, or blended, oversize welds as required; grind to provide a smooth transition and to match profile on approved mock-up .
 3. Continuous Welds: Where noted on the drawings, provide continuous welds of a uniform size and profile.
 4. Minimize Weld Show Through: At locations where welding on the far side of an exposed connection occurs, grind distortion and marking of the steel to a smooth profile with adjacent material.
- B. Immediately after welding, touch-up welds, burned areas and damaged surface coatings.

1. Thoroughly remove all spatter by power wire-brushing (or if inaccessible, wire brushing) per SSPC, surface preparation specification SP2 or SP3. Allow surface to cool to ambient temperature. Clean surface with solvent wipe to remove oils, grease and dirt in accordance with SSPC surface preparation specification SP1.
2. Apply one coat of liquid zinc to attain a minimum of 1.5 mils dry film thickness. Coating should extend at least two inches beyond either side of weldment to ensure complete coverage of welded area.

3.3 FIELD BOLTING

- A. Accurately drive all bolts into holes, protecting the bolt heads so as not to damage the thread during the driving. Ensure that bolt heads and nuts rest squarely against the metal. Where structural members have sloping flange faces, provide approved beveled washers at the bolted connections to afford square seating for bolt heads or nuts. Nick bolt threads for unfinished bolts to prevent the nuts from backing off.
 1. Bolt Head Orientation: All bolt heads shall be oriented as indicated on the contract documents. Where bolt-head alignment is specified, the orientation shall be noted for each connection on the erection drawings. Where not noted, the bolt heads in a given connection shall be oriented to one side.
- B. Use an approved calibrated manual or power torque wrench to obtain the proper torque and tension as recommended by the bolt manufacturer for all ASTM A 325 bolts.

3.4 INSTALLATION OF RAILINGS

- A. Adjust railings prior to anchoring to ensure matching alignment at abutting joints. Space posts at spacing indicated, or if not indicated, as required by design loading. Plumb posts in each direction. Secure posts and railing ends to building construction as follows:
 1. Anchor posts in concrete by means of pipe sleeves providing at least 1/2 inch clearance around entire perimeter of post, preset and anchored into concrete. After posts have been inserted into sleeves, fill annular space between post and sleeve solid with nonmetallic, nonshrink grout, mixed and placed to comply with grout manufacturer's directions.
 - a. For setting into colored concrete; hold grout back 1/2 inch from finish surface and fill void with Portland cement grout matching color and texture of adjacent surface.
 - b. Leave anchorage joint exposed, wipe off surplus grout, and leave 1/8" build-up, sloped away from post.
 2. Anchor posts to steel with steel flanges, angle type or floor type as required by conditions, welded to posts and bolted to steel supporting members.
 3. Anchor rail ends into concrete and masonry with round steel flanges welded to rail ends and anchored into wall construction with lead expansion shields and bolts.
 4. Anchor rail ends to steel with round flanges welded to rail ends and bolted to structural steel members, unless otherwise indicated.
 5. Install removable railing sections where indicated in slip-fit metal sockets cast into concrete. Accurately locate sockets to match post spacing.

July 11, 2018

- B. Secure handrails to wall with wall brackets and end fittings. Provide bracket with not less than 1-1/2" clearance from inside face of handrail and finished wall surface. Locate brackets as indicated, or if not indicated, at spacing required to support structural loads. Secure rails to walls with wall brackets, wall return fittings and anchor plates, in a manner required to meet code requirements, and as follows:
 - 1. Each bracket shall be fastened with not less than 2 bolts.
 - 2. For concrete and solid masonry anchorage, use drilled-in expansion shield and either concealed hanger bolt or exposed lag bolt, as applicable.
 - 3. For hollow masonry anchorage, use toggle bolts having square heads.
 - 4. For steel framed gypsum board assemblies, fasten brackets directly to steel framing or concealed anchors to steel reinforcing plate, using bolts of size and type required to support structural loads.
 - 5. For wood stud partitions, use lag bolts set into wood blocking or backing between studs. Coordinate with stud installations for accurate location of blocking or backing members.

3.5 TOUCH-UP

- A. Touch-up all welds, burned areas, scratches, abrasions, on galvanized metals, using specified liquid zinc coating.
- B. Touch-up all welds, scratches, abrasions, and other surface damaged on shop-primed or painted metals, using the same coatings as specified under shop applied finishes, herein above.

3.6 SUPPLEMENTAL SCHEDULES

- A. General: Items listed herein below provide further description of those already indicated in the Drawings. This list does not represent a complete list of miscellaneous metal components or types required to complete the Work.
 - 1. Carefully review all Drawings and furnish and install metal fabrications required by the various trades, whether or not specifically listed herein, such as miscellaneous clip angles, miscellaneous steel bracketing, and other miscellaneous metal items as indicated on the Drawings, reasonably implied therefrom, or reasonably necessary for the thorough completion of the work.
- B. Interior railings (guardrails and handrails), as detailed on the Drawings. Connections and sizing to conform to engineering and code requirements specified herein above.
- C. Exterior railings: 1-1/4 inch (I.D.) steel pipe as detailed on the Drawings. Fabricated assemblies shall be hot-dipped galvanized, shop primed and shop finished.
 - 1. Pipe railings: To prevent unnecessary damage to the galvanized coating by field welding, provide slip-fit method of connecting pipe railings. Fabricate pipe railing from mechanical steel tubing internally vented with holes 3/4 the size of the pipe's internal diameter.
- D. Elevator pit ladders: Stringers 3/8-inch by 1-1/2 inch flat bar, rungs 3/4 inch diameter solid steel rods. Offset ladder from wall surface by 7 inches to centerline of rungs, with brackets.

1. Fabricate ladders in accordance with OSHA requirements, and ANSI A14.3 standards.
2. Hot dip galvanized finish assembled elevator pit ladders.

E. Loose lintels: Steel angles complying with ASTM Designation A 36; in accordance with the following schedules:

1. Provide one angle for every nominal 4 inch width in 4, 8 and 12 inch width walls/partitions per the following table:

Maximum Opening	Interior Opening	Exterior Opening
Up to 4'-0"	4 x 3-1/2 x 5/16"	4 x 3-1/2 x 3/8"
4'-1" to 6'-0"	5 x 3-1/2 x 5/16"	5 x 3-1/2 x 3/8"
6'-1" to 8'-0"	6 x 3-1/2 x 5/16"	6 x 3-1/2 x 3/8"

2. Provide structural tees for 6 inch width walls/partitions per the following table:

Maximum Opening	Structural Tee
Up to 4'-0"	WT4
Up to 6'-0"	WT4 X 9
Up to 8'-0"	WT8 X 13

3. Provide lintels 12 inches longer than masonry openings. Where lintel abuts column, provide structural clip connection.
4. Lintels occurring in exterior walls shall be galvanized in conformance with the requirements of ASTM A 143, and ASTM A 123.

End of Section

Section 06 10 00
ROUGH CARPENTRY

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. Framing with dimension lumber.
 - 2. Framing with engineered wood products.
 - 3. Rooftop equipment bases and support curbs.
 - 4. Wood blocking, cants, and nailers.
 - 5. Wood furring and grounds.
 - 6. Wood sleepers.
 - 7. Plywood backing panels.
- B. Related Sections include the following:
 - 1. Division 06 Section "Sheathing."
 - 2. Division 31 Section "Termite Control" for site application of borate treatment to wood framing.

1.3 DEFINITIONS

- A. Exposed Framing: Framing not concealed by other construction.
- B. Dimension Lumber: Lumber of 2 inches nominal or greater but less than 5 inches nominal in least dimension.
- C. Lumber grading agencies, and the abbreviations used to reference them, include the following:
 - 1. NeLMA: Northeastern Lumber Manufacturers' Association.
 - 2. NLGA: National Lumber Grades Authority.
 - 3. SPIB: The Southern Pine Inspection Bureau.
 - 4. WCLIB: West Coast Lumber Inspection Bureau.
 - 5. WWPA: Western Wood Products Association.

July 11, 2018

1.4 SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
 2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
 3. For fire-retardant treatments specified to be High-Temperature (HT) type, include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D 5664.
 4. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
 5. Include copies of warranties from chemical treatment manufacturers for each type of treatment.
- B. Fastener Patterns: Full-size templates for fasteners in exposed framing.
- C. LEED Submittals:
1. Product Data for Credit EQ 4.1: For adhesives, including printed statement of VOC content.
 2. Product Data for Credit EQ 4.4: For composite-wood products, documentation indicating that product contains no urea formaldehyde.
 3. Certificates for Credit MR 7: Chain-of-custody certificates certifying that products specified to be made from certified wood comply with forest certification requirements. Include evidence that mill is certified for chain of custody by an FSC-accredited certification body.
 - a. Include statement indicating costs for each certified wood product.
- D. 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 ALSC Board of Review.
- E. 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. Engineered wood products.
 4. Power-driven fasteners.
 5. Powder-actuated fasteners.
 6. Expansion anchors.
 7. Metal framing anchors.

July 11, 2018

1.5 QUALITY ASSURANCE

- A. Source Limitations for Engineered Wood Products: Obtain each type of engineered wood product through one source from a single manufacturer.
- B. 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 STD-01-001, "FSC Principles and Criteria for Forest Stewardship":
 - 1. Dimension lumber framing.
 - 2. Laminated-veneer lumber.
 - 3. Parallel-strand lumber.
 - 4. Miscellaneous lumber.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Stack lumber flat with spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

- A. Lumber: DOC PS 20 and applicable rules of 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 or omit grade stamp and provide certificates of grade compliance issued by grading agency.
 - 3. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.
 - 4. Provide dressed lumber, S4S, unless otherwise indicated.
- B. Engineered Wood Products: Provide engineered wood products acceptable to authorities having jurisdiction and for which current model code research or evaluation reports exist that show compliance with building code in effect for Project.
 - 1. Allowable Design Stresses: Provide engineered wood products with allowable design stresses, 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.

2.2 WOOD-PRESERVATIVE-TREATED LUMBER

- A. Preservative Treatment by Pressure Process: AWPA C2, except that lumber that is not in contact with the ground and is continuously protected from liquid water may be treated according to AWPA C31 with inorganic boron (SBX).
 - 1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
 - 2. For exposed items indicated to receive a stained or natural finish, use chemical formulations that do not require incising, contain colorants, bleed through, or otherwise adversely affect finishes.
- B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or does not comply with requirements for untreated material.
- C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.
 - 1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece or omit marking and provide certificates of treatment compliance issued by inspection agency.
- D. Application: Treat all rough carpentry, unless otherwise indicated, items indicated on Drawings, and the following:
 - 1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
 - 2. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.
 - 3. Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.
 - 4. Wood framing members that are less than 18 inches above the ground in crawlspaces or unexcavated areas.
 - 5. Wood floor plates that are installed over concrete slabs-on-grade.

2.3 FIRE-RETARDANT-TREATED MATERIALS

- A. General: Comply with performance requirements in AWPA C20 (lumber) and AWPA C27 (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.

1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece or omit marking and provide certificates of treatment compliance issued by inspection agency.
- C. For exposed items indicated to receive a stained or natural finish, use chemical formulations that do not bleed through, contain colorants, or otherwise adversely affect finishes.
- D. Application: Treat all rough carpentry, unless otherwise indicated, items indicated on Drawings, and the following:
 1. Framing for raised platforms.
 2. Concealed blocking.
 3. Framing for non-load-bearing partitions.
 4. Framing for non-load-bearing exterior walls.
 5. Roof construction.
 6. Plywood backing panels.

2.4 DIMENSION LUMBER FRAMING

- A. Maximum Moisture Content: 19 percent for all lumber.
- B. Non-Load-Bearing Interior Partitions: Construction or No. 2 grade and any of the following species:
 1. Hem-fir (north); NLGA.
 2. Mixed southern pine; SPIB.
 3. Spruce-pine-fir; NLGA.
 4. Hem-fir; WCLIB, or WWPA.
 5. Spruce-pine-fir (south); NeLMA, WCLIB, or WWPA.
 6. Northern species; NLGA.
 7. Eastern softwoods; NeLMA.
 8. Western woods; WCLIB or WWPA.
- C. Exterior and Load-Bearing Walls: No. 1 Construction grade and any of the following species:
 1. Hem-fir (north); NLGA.
 2. Southern pine; SPIB.
 3. Douglas fir-larch; WCLIB or WWPA.
 4. Mixed southern pine; SPIB.
 5. Spruce-pine-fir; NLGA.
 6. Douglas fir-south; WWPA.
 7. Hem-fir; WCLIB or WWPA.
 8. Douglas fir-larch (north); NLGA.
 9. Spruce-pine-fir (south); NeLMA, WCLIB, or WWPA.
- D. Exterior and Load-Bearing Walls: Any species and grade with a modulus of elasticity of at least 1,300,000 psi and an extreme fiber stress in bending of at least 1000 psi for 2-inch nominal thickness and 12-inch nominal width for single-member use.

July 11, 2018

- E. Ceiling Joists (Non-Load-Bearing): Standard, Stud, or No. 3 grade of any species.
- F. Joists, Rafters, and Other Framing Not Listed Above: Construction or No. 1 grade and any of the following species:
 - 1. Hem-fir (north); NLGA.
 - 2. Southern pine; SPIB.
 - 3. Douglas fir-larch; WCLIB or WWPA.
 - 4. Mixed southern pine; SPIB.
 - 5. Spruce-pine-fir; NLGA.
 - 6. Douglas fir-south; WWPA.
 - 7. Hem-fir; WCLIB or WWPA.
 - 8. Douglas fir-larch (north); NLGA.
 - 9. Spruce-pine-fir (south); NeLMA, WCLIB, or WWPA.
- G. Joists, Rafters, and Other Framing Not Listed Above: Any species and grade with a modulus of elasticity of at least 1,300,000 psi and an extreme fiber stress in bending of at least 1000 psi for 2-inch nominal thickness and 12-inch nominal width for single-member use.

2.5 ENGINEERED WOOD PRODUCTS

- A. Laminated-Veneer Lumber: Structural composite lumber made from wood veneers with grain primarily parallel to member lengths, evaluated and monitored according to ASTM D 5456 and manufactured with an exterior-type adhesive complying with ASTM D 2559, and containing no urea formaldehyde.
 - 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:
 - a. Boise Cascade Corporation.
 - b. Georgia-Pacific.
 - c. Louisiana-Pacific Corporation.
 - d. Pacific Woodtech Corporation.
 - e. Roseburg Forest Products Co.
 - f. Weyerhaeuser Company.
 - 3. Extreme Fiber Stress in Bending: 2800 psi.
 - 4. Modulus of Elasticity: 1,900,000 psi .
- B. Parallel-Strand Lumber: Structural composite lumber made from wood strand elements with grain primarily parallel to member lengths, evaluated and monitored according to ASTM D 5456 and manufactured with an exterior-type adhesive complying with ASTM D 2559, and containing no urea formaldehyde.
 - 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:
 - a. Weyerhaeuser Company.
3. Extreme Fiber Stress in Bending: 2900 psi.
4. Modulus of Elasticity, Edgewise: 2,200,000 psi.

2.6 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. Rooftop equipment bases and support curbs.
 4. Cants.
 5. Furring.
 6. Grounds.
- B. For items of dimension lumber size, provide Construction grade lumber with 19 percent maximum moisture content and any species.

2.7 PLYWOOD BACKING PANELS

- A. Telephone and Electrical Equipment Backing Panels: DOC PS 1, Exposure 1, C-D Plugged fire-retardant treated,] in thickness indicated or, if not indicated, not less than ¼ inch nominal thickness.

2.8 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.
 1. Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M, or Type 304 stainless steel.
- B. Nails, Brads, and Staples: ASTM F 1667.
- C. Power-Driven Fasteners: NES NER-272.
- D. Wood Screws: ASME B18.6.1.
- E. Lag Bolts: ASME B18.2.1.
- F. Bolts: Steel bolts complying with ASTM A 307, Grade A, with ASTM A 563 hex nuts and, where indicated, flat washers.

G. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.

1. Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.
2. Material: Stainless steel with bolts and nuts complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2 .

2.9 METAL FRAMING ANCHORS

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. 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 coating designation.

1. Use for interior locations where stainless steel is not indicated.

D. Stainless-Steel Sheet: ASTM A 666, Type 304.

1. Use for exterior locations and where indicated.

E. Joist Hangers: U-shaped joist hangers with 2-inch long seat and 1-1/4-inch- wide nailing flanges at least 85 percent of joist depth.

1. Thickness: 0.062 inch.

F. Top Flange Hangers: U-shaped joist hangers, full depth of joist, formed from metal strap with tabs bent to extend over and be fastened to supporting member.

1. Strap Width: 2 inches.
2. Thickness: 0.062 inch.

July 11, 2018

- G. Bridging: Rigid, V-section, nailless type, 0.050 inch thick, length to suit joist size and spacing.
- H. Post Bases: Adjustable-socket type for bolting in place with standoff plate to raise post 1 inch above base and with 2 inch minimum side cover, socket 0.062 inch thick, and standoff and adjustment plates 0.108 inch thick.
- I. Joist Ties: Flat straps, with holes for fasteners, for tying joists together over supports.
 - 1. Width: 3/4 inch.
 - 2. Thickness: 0.062 inch.
 - 3. Length: 24 inches.
- J. Rafter Tie-Downs (Hurricane or Seismic Ties): Bent strap tie for fastening rafters or roof trusses to wall studs below, 2-1/4 inches wide by 0.062 inch thick. Tie fits over top of rafter or truss and fastens to both sides of rafter or truss, face of top plates, and side of stud below.
- K. Hold-Downs: Brackets for bolting to wall studs and securing to foundation walls with anchor bolts or to other hold-downs with threaded rods and designed with first of two bolts placed seven bolt diameters from reinforced base.
 - 1. Bolt Diameter: 3/4 inch.
 - 2. Width: 3-3/16 inches.
 - 3. Body Thickness: 0.138 inch.
 - 4. Base Reinforcement Thickness: 0.239 inch.

2.10 MISCELLANEOUS MATERIALS

- A. Sill-Sealer Gaskets: Glass-fiber-resilient insulation, fabricated in strip form, for use as a sill sealer; 1 inch nominal thickness, compressible to 1/32 inch; selected from manufacturer's standard widths to suit width of sill members indicated.
- B. Flexible Flashing: Self-adhesive, rubberized-asphalt compound, bonded to a high-density, polyethylene film to produce an overall thickness of not less than 0.025 inch.
- C. Adhesives for Gluing Furring and Sleepers to Concrete or Masonry: Formulation complying with ASTM D 3498 that is approved for use indicated by adhesive manufacturer.
 - 1. Use adhesives that have a VOC content of 70 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- D. Water-Repellent Preservative: NWWDA-tested and -accepted formulation containing 3-iodo-2-propynyl butyl carbamate, combined with an insecticide containing chloropyrifos as its active ingredient.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry to other construction; scribe and cope as needed for accurate fit. Locate furring, nailers, blocking, 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. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.
 - 1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches o.c.
- G. Provide fire blocking in furred spaces, stud spaces, and other concealed cavities as indicated and as follows:
 - 1. Fire block furred spaces of walls, at each floor level, at ceiling, and at not more than 96 inches o.c. with solid wood blocking or noncombustible materials accurately fitted to close furred spaces.
 - 2. Fire block concealed spaces of wood-framed walls and partitions at each floor level, at ceiling line of top story, and at not more than 96 inches o.c. Where fire blocking is not inherent in framing system used, provide closely fitted solid wood blocks of same width as framing members and 2-inch nominal thickness.
 - 3. Fire block concealed spaces between floor sleepers with same material as sleepers to limit concealed spaces to not more than 100 sq. ft. and to solidly fill space below partitions.
 - 4. Fire block concealed spaces behind combustible cornices and exterior trim at not more than 20 feet o.c.
- H. Sort and select lumber so that natural characteristics will not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.
- I. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.

July 11, 2018

1. Use inorganic boron for items that are continuously protected from liquid water.
 2. Use copper naphthenate for items not continuously protected from liquid water.
- J. 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.
- K. Use common wire nails, unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood; do not countersink nail heads, unless otherwise indicated.
- L. For exposed work, arrange fasteners in straight rows parallel with edges of members, with fasteners evenly spaced, and with adjacent rows staggered.
1. Comply with indicated fastener patterns where applicable. Before fastening, mark fastener locations, using a template made of sheet metal, plastic, or cardboard.
 2. Use finishing nails, unless otherwise indicated.
- 3.2 WOOD GROUND, SLEEPER, BLOCKING, AND NAILER INSTALLATION
- A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.
 - B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces, unless otherwise indicated.
 - C. Where wood-preserved-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.
 - D. Provide permanent grounds of dressed, pressure-preserved-treated, key-beveled lumber not less than 1-1/2 inches wide and of thickness required to bring face of ground to exact thickness of finish material. Remove temporary grounds when no longer required.

July 11, 2018

3.3 WOOD FURRING INSTALLATION

- A. Install level and plumb with closure strips at edges and openings. Shim with wood as required for tolerance of finish work.
- B. Furring to Receive Plywood or Hardboard Paneling: Install 1-by-3-inch nominal size furring horizontally and/or vertically at 16 inches o.c.
- C. Furring to Receive Gypsum Board: Install 1-by-2-inch nominal vertically at 16 inches o.c.

3.4 WALL AND PARTITION FRAMING INSTALLATION

- A. General: Provide single bottom plate and double top plates using members of 2-inch nominal thickness whose widths equal that of studs, except single top plate may be used for non-load-bearing partitions. Fasten plates to supporting construction, unless otherwise indicated.
 - 1. For exterior walls, provide 2-by-6-inch nominal size wood studs spaced 16 inches o.c., unless otherwise indicated.
 - 2. For interior partitions and walls, provide 2-by-6-inch nominal wood studs spaced 16 inches, unless otherwise indicated.
 - 3. Provide continuous horizontal blocking at midheight of partitions more than 96 inches high, using members of 2 inch nominal thickness and of same width as wall or partitions.
- B. Construct corners and intersections with three or more studs, except that two studs may be used for interior non-load-bearing partitions.
- C. Frame openings with multiple studs and headers. Provide nailed header members of thickness equal to width of studs. Support headers on jamb studs.
 - 1. For non-load-bearing partitions, provide double-jamb studs and headers not less than 4-inch nominal depth for openings 48 inches and less in width, 6-inch nominal depth for openings 48 to 72 inches, 8-inch nominal depth for openings 72 to 120 inches in width, and not less than 10-inch nominal depth for openings 10 to 12 feet in width.
 - 2. For load-bearing walls, provide double-jamb studs for openings 60 inches and less in width, and triple-jamb studs for wider openings. Provide headers of depth indicated.

3.5 CEILING JOIST AND RAFTER FRAMING INSTALLATION

- A. Ceiling Joists: Install ceiling joists with crown edge up and complying with requirements specified above for floor joists. Face nail to ends of parallel rafters.
 - 1. Where ceiling joists are at right angles to rafters, provide additional short joists parallel to rafters from wall plate to first joist; nail to ends of rafters and to top plate and nail to first joist or anchor with framing anchors or metal straps.

Provide 1-by-8-inch nominal size or 2-by-4-inch nominal size stringers spaced 48 inches o.c. crosswise over main ceiling joists.

- B. Rafters: Notch to fit exterior wall plates and toe nail or use metal framing anchors. Double rafters to form headers and trimmers at openings in roof framing, if any, and support with metal hangers. Where rafters abut at ridge, place directly opposite each other and nail to ridge member or use metal ridge hangers.
 - 1. At valleys, provide double-valley rafters of size indicated or, if not indicated, of same thickness as regular rafters and 2 inches deeper. Bevel ends of jack rafters for full bearing against valley rafters.
 - 2. At hips, provide hip rafter of size indicated or, if not indicated, of same thickness as regular rafters and 2 inches deeper. Bevel ends of jack rafters for full bearing against hip rafter.
- C. Provide collar beams (ties) as indicated or, if not indicated, provide 1-by-6-inch nominal size boards between every third pair of rafters, but not more than 48 inches o.c. Locate below ridge member, at third point of rafter span. Cut ends to fit roof slope and nail to rafters.
- D. Provide special framing as indicated for eaves, overhangs, dormers, and similar conditions, if any.

3.6 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.
- B. Protect rough carpentry from weather. If, despite protection, rough carpentry becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

End of Section

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Section 06 16 00
SHEATHING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:

1. Wall sheathing.
2. Roof sheathing.
3. Composite nail base insulated roof sheathing.
4. Subflooring.
5. Underlayment.
6. Building paper.
7. Building wrap.
8. Sheathing joint-and-penetration treatment.
9. Flexible flashing at openings in sheathing.

- B. Related Sections include the following:

1. Division 06 Section Rough Carpentry for plywood backing panels.

1.3 SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Indicate type of preservative used and net amount of preservative retained.
2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Include physical properties of treated materials.
3. For fire-retardant treatments specified to be High-Temperature (HT) type, include physical properties of treated plywood both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D 5516.
4. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
5. Include copies of warranties from chemical treatment manufacturers for each type of treatment.

6. For building wrap, include data on air-/moisture-infiltration protection based on testing according to referenced standards.

B. LEED Submittals:

1. Product Data for Credit EQ 4.1: For adhesives, including printed statement of VOC content.
2. Product Data for Credit EQ 4.4: For composite-wood products, documentation indicating that product contains no urea formaldehyde.
3. Certificates for Credit MR 7: Chain-of-custody certificates certifying that products specified to be made from certified wood comply with forest certification requirements. Include evidence that manufacturer is certified for chain of custody by an FSC-accredited certification body.
 - a. Include statement indicating costs for each certified wood product.

C. Research/Evaluation Reports: For the following, showing compliance with building code in effect for Project:

1. Preservative-treated plywood.
2. Fire-retardant-treated plywood.
3. Foam-plastic sheathing.
4. Building wrap.

1.4 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: For assemblies with fire-resistance ratings, provide materials and construction identical to those of assemblies tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.

1. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory.", GA-600, "Fire Resistance Design Manual."

B. 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 STD-01-001, "FSC Principles and Criteria for Forest Stewardship":

1. Plywood.
2. Oriented strand board.
3. Fiberboard wall sheathing.
4. Particleboard underlayment.
5. Hardboard underlayment.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Stack plywood and other panels flat with spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PANEL PRODUCTS, GENERAL

- A. Plywood: DOC PS 1.
- B. Oriented Strand Board: DOC PS 2.
- C. Thickness: As needed to comply with requirements specified, but not less than thickness indicated.
- D. Factory mark panels to indicate compliance with applicable standard.

2.2 PRESERVATIVE-TREATED PLYWOOD

- A. Preservative Treatment by Pressure Process: AWPA C9.
 - 1. Preservative Chemicals: Acceptable to authorities having jurisdiction, and containing no arsenic or chromium.
- B. Mark plywood with appropriate classification marking of an inspection agency acceptable to authorities having jurisdiction.
- C. Application: Treat items indicated on Drawings, and plywood in contact with masonry or concrete or used with roofing, flashing, vapor barriers, and waterproofing.

2.3 FIRE-RETARDANT-TREATED PLYWOOD

- A. General: Comply with performance requirements in AWPA C27.
 - 1. Use treatment that does not promote corrosion of metal fasteners.
 - 2. Use Exterior type for exterior locations and where indicated.
 - 3. Use Interior Type A, High Temperature (HT) for roof sheathing and where indicated.
 - 4. Use Interior Type A, unless otherwise indicated.
- B. Kiln-dry material after treatment to maximum moisture content of 15 percent. Do not use material that is warped or does not comply with requirements for untreated material.
- C. Identify fire-retardant-treated plywood with appropriate classification marking of UL, U.S. Testing, Timber Products Inspection, or another testing and inspecting agency acceptable to authorities having jurisdiction.
- D. Application: Treat plywood indicated on Drawings.

2.4 WALL SHEATHING

- A. Plywood Wall Sheathing: Exterior, Structural I sheathing.

1. Span Rating: Not less than 32/16.
 2. Nominal Thickness: Not less than 1/2 inch.
- B. Oriented-Strand-Board Wall Sheathing: Exposure 1, Structural I sheathing.
1. Span Rating: Not less than 32/16.
 2. Nominal Thickness: Not less than 1/2 inch.
- C. Paper-Surfaced Gypsum Wall Sheathing: ASTM C 79/C 79M or ASTM C 1396/C 1396M, gypsum sheathing; with water-resistant-treated core and with water-repellent paper bonded to core's face, back, and long edges.
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:
 - a. American Gypsum.
 - b. LaFarge North America Inc.
 - c. G-P Gypsum Corporation.
 - d. National Gypsum Company.
 - e. Temple-Inland Forest Products Corporation.
 - f. United States Gypsum Co.
 3. Type and Thickness: Regular, 1/2 inch Type X, or 5/8 inch thick, as indicated.
 4. Edge and End Configuration: square ends.
 5. Size: 48 by 96 inches.
- D. Glass-Mat Gypsum Wall Sheathing: ASTM C 1177/1177M.
1. Product: Subject to compliance with requirements, provide "Dens-Glass Gold" by G-P Gypsum Corporation.
 2. Type and Thickness: Regular, 1/2 inch thick.
 3. Size: 48 by 96 inches for vertical installation.
- E. Cellulose Fiber-Reinforced Gypsum Sheathing: ASTM C 1278/C 1278M, gypsum sheathing.
1. Product: Subject to compliance with requirements, provide "Fiberock Sheathing with Aqua-Tough" by United States Gypsum Co.
 2. Type and Thickness: Regular, 1/2 inch thick.
 3. Size: 48 by 96 inches.
- F. Fiberboard Wall Sheathing: ASTM C 208, Type IV, Grade 1 (Regular) cellulosic fiberboard sheathing with square edges, 1/2 inch thick.
- G. Extruded-Polystyrene-Foam Wall Sheathing: ASTM C 578, Type IV, in manufacturer's standard lengths and widths with tongue-and-groove or shiplap long edges as standard with manufacturer.

July 11, 2018

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:
 - a. DiversiFoam Products.
 - b. Dow Chemical Company.
 - c. Owens Corning.
 - d. Pactiv, Inc.
 3. Thickness: 3/4 inch.
- H. Foil-Faced, Polyisocyanurate-Foam Wall Sheathing: ASTM C 1289, Type I, Class 2, aluminum-foil-faced, glass-fiber-reinforced, rigid, cellular, polyisocyanurate thermal insulation. Foam-plastic core and facings shall have a flame-spread index of 25 or less when tested individually.
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:
 - a. Apache Products Company.
 - b. Dow Chemical Company (The).
 - c. Johns Manville; Berkshire Hathaway Inc.
 - d. Rmax, Inc.
 3. Thickness: As indicated.
- 2.5 ROOF SHEATHING
- A. Plywood Roof Sheathing: Exterior, Structural I sheathing.
1. Span Rating: Not less than 48/24.
 2. Nominal Thickness: Not less than 3/4 inch.
- 2.6 SUBFLOORING AND UNDERLAYMENT
- A. Plywood Combination Subfloor-Underlayment: DOC PS 1, Exterior, Structural I, single-floor panels.
1. Span Rating: Not less than 16 o.c.
 2. Nominal Thickness: Not less than 3/4 inch.
 3. Edge Detail: Square.
 4. Edge Detail: Tongue and groove.
 5. Surface Finish: Fully sanded face.
- B. Oriented-Stand-Board Combination Subfloor-Underlayment: Exposure 1 single-floor panels.

July 11, 2018

1. Span Rating: Not less than 16 o.c.
 2. Nominal Thickness: Not less than 7/8 inch.
 3. Edge Detail: Square.
 4. Edge Detail: Tongue and groove.
 5. Surface Finish: Fully sanded face.
- C. Plywood Subflooring: Exterior, Structural I single-floor panels or sheathing.
1. Span Rating: Not less than 32/16.
 2. Nominal Thickness: Not less than 3/4 inch.
- D. Oriented-Strand-Board Subflooring: Exposure 1, Structural I sheathing.
1. Span Rating: Not less than 16 o.c. or 32/16.
 2. Nominal Thickness: Not less than 7/8 inch.
- E. Underlayment, General: Provide underlayment in nominal thicknesses indicated or, if not indicated, not less than 3/8 inch.
- F. Plywood Underlayment for Resilient Flooring: DOC PS 1, Exterior A-C, Exposure 1 Underlayment] with fully sanded face.
- G. Plywood Underlayment for Ceramic Tile: DOC PS 1, Exterior, C-C Plugged, not less than 5/8-inch nominal thickness, for ceramic tile set in epoxy adhesive.
- H. Plywood Underlayment for Carpet: DOC PS 1, Exposure 1 Underlayment.
- I. Particleboard Underlayment: ANSI A208.1, Grade M-2, Exterior Glue, complying with dimensional tolerances and thickness swell requirements of Grade PBU.
- J. Hardboard Underlayment: AHA A135.4, Class 4 (Service), Surface S1S; with back side sanded.

2.7 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.
1. For roof and wall sheathing, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M, or of Type 304 stainless steel.
- B. Nails, Brads, and Staples: ASTM F 1667.
- C. Power-Driven Fasteners: NES NER-272.
- D. Wood Screws: ASME B18.6.1.
- E. Screws for Fastening Wood Structural Panels to Cold-Formed Metal Framing: ASTM C 954, except with wafer heads and reamer wings, length as recommended by screw manufacturer for material being fastened.

July 11, 2018

1. For wall and roof sheathing panels, provide screws with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B 117.
- F. Screws for Fastening Gypsum Sheathing to Cold-Formed Metal Framing: Steel drill screws, in length recommended by sheathing manufacturer for thickness of sheathing board to be attached, with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B 117.
1. For steel framing less than 0.0329 inch thick, attach sheathing to comply with ASTM C 1002.
 2. For steel framing from 0.033 to 0.112 inch thick, attach sheathing to comply with ASTM C 954.

2.8 WEATHER-RESISTANT SHEATHING PAPER

- A. Building Paper: ASTM D 226, Type 1 (No. 15 asphalt-saturated organic felt), unperforated.
- B. Building Paper: UBC Standard 14-1, Grade D (water-vapor-permeable, kraft building paper, except that water resistance shall be not less than 1 hour and water-vapor transmission shall be not less than 75 g/sq. m x 24 h.
- C. Building Wrap: ASTM E 1677, Type I air retarder; with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, when tested according to ASTM E 84; UV stabilized; and acceptable to authorities having jurisdiction.
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 2. Products: Subject to compliance with requirements, provide one of the following:
 - a. Dow Chemical Company (The); Styrofoam Weathermate Plus Brand Housewrap.
 - b. DuPont (E. I. du Pont de Nemours and Company); Tyvek CommercialWrap.
 - c. Ludlow Coated Products; Barricade Building Wrap.
 - d. Pactiv, Inc.; GreenGuard Classic Wrap.
 - e. Raven Industries Inc.; Rufco-Wrap.
 - f. Reemay, Inc.; Typar HouseWrap.
 3. Water-Vapor Permeance: Not less than 535 g through 1 sq. m of surface in 24 hours per ASTM E 96, Desiccant Method (Procedure A).
 4. Allowable UV Exposure Time: Not less than three months.
- D. Building-Wrap Tape: Pressure-sensitive plastic tape recommended by building-wrap manufacturer for sealing joints and penetrations in building wrap.

2.9 SHEATHING JOINT-AND-PENETRATION TREATMENT MATERIALS

- A. Sealant for Glass-Mat Gypsum Sheathing Board: Elastomeric, medium-modulus, neutral-curing silicone joint sealant compatible with joint substrates formed by gypsum

July 11, 2018

sheathing and other materials, recommended by sheathing manufacturer for application indicated, and complying with requirements for elastomeric sealants specified in Division 07 Section "Joint Sealants."

- B. Sealant for Glass-Mat Gypsum Sheathing Board: Silicone emulsion sealant complying with ASTM C 834, compatible with sheathing tape and sheathing, and recommended by tape and sheathing manufacturers for use with glass-fiber sheathing tape and for covering exposed fasteners.
- C. Sheathing Tape for Glass-Mat Gypsum Sheathing Board: Self-adhering glass-fiber tape, minimum 2 inches wide, 10 by 10 or 10 by 20 threads/inch, of type recommended by sheathing and tape manufacturers for use with silicone emulsion sealant in sealing joints in glass-mat gypsum sheathing board and with a history of successful in-service use.
- D. Sheathing Tape for Foam-Plastic Sheathing: Pressure-sensitive plastic tape recommended by sheathing manufacturer for sealing joints and penetrations in sheathing.

2.10 MISCELLANEOUS MATERIALS

- A. Adhesives for Field Gluing Panels to Framing: Formulation complying with APA AFG-01 that is approved for use with type of construction panel indicated by manufacturers of both adhesives and panels.
 - 1. Use adhesives that have a VOC content of 70 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, rubberized-asphalt compound, bonded to a high-density, cross-laminated polyethylene film to produce an overall thickness of not less than 0.030 inch.
 - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - 2. Products: Subject to compliance with requirements, provide one of the following:
 - a. Carlisle Coatings & Waterproofing; CCW-705-TWF Thru-Wall Flashing.
 - b. Grace Construction Products, a unit of W. R. Grace & Co. - Conn.; Vycor Plus Self-Adhered Flashing.
 - c. MFM Building Products Corp.; Window Wrap.
 - d. Polyguard Products, Inc.; Polyguard 300.
 - e. Protecto Wrap Company; BT-20 XL.
- C. Primer for Flexible Flashing: Product recommended by manufacturer of flexible flashing for substrate.

July 11, 2018

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement.
- B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction, unless otherwise indicated.
- C. Securely attach to substrate by 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."
- D. Use common wire nails, unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections. Install fasteners without splitting wood.
- E. Coordinate wall and roof sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.
- F. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.
- G. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

3.2 WOOD STRUCTURAL PANEL INSTALLATION

- A. General: Comply with applicable recommendations in APA Form No. E30S, "Engineered Wood Construction Guide," for types of structural-use panels and applications indicated.
- B. Fastening Methods: Fasten panels as indicated below:
 - 1. Combination Subfloor-Underlayment:
 - a. Glue and nail to wood framing.

- b. Screw to cold-formed metal framing.
- c. Space panels 1/8 inch apart at edges and ends.
- 2. Subflooring:
 - a. Glue and nail to wood framing.
 - b. Screw to cold-formed metal framing.
 - c. Space panels 1/8 inch apart at edges and ends.
- 3. Wall and Roof Sheathing:
 - a. Glue and nail to wood framing.
 - b. Screw to cold-formed metal framing.
 - c. Space panels 1/8 inch apart at edges and ends.
- 4. Underlayment:
 - a. Nail to subflooring.
 - b. Space panels 1/8 inch apart at edges and ends.
 - c. Fill and sand edge joints of underlayment receiving resilient flooring right before installing flooring.

3.3 GYPSUM SHEATHING INSTALLATION

- A. Comply with GA-253 and with manufacturer's written instructions.
 - 1. Fasten gypsum sheathing to wood framing with nails or screws.
 - 2. Fasten gypsum sheathing to cold-formed metal framing with screws.
 - 3. Install boards with a 3/8-inch gap where non-load-bearing construction abuts structural elements.
 - 4. Install boards with a 1/4-inch gap where they abut masonry or similar materials that might retain moisture, to prevent wicking.
- B. Apply fasteners so heads bear tightly against face of sheathing boards but do not cut into facing.
- C. Horizontal Installation: Install sheathing with V-grooved edge down and tongue edge up. Interlock tongue with groove to bring long edges in contact with edges of adjacent boards without forcing. Abut ends of boards over centers of studs, and stagger end joints of adjacent boards not less than one stud spacing. Attach boards at perimeter and within field of board to each steel stud.
 - 1. Space fasteners approximately 8 inches o.c. and set back a minimum of 3/8 inch from edges and ends of boards.
 - 2. For sheathing under stucco cladding, boards may be initially tacked in place with screws if overlying self-furring metal lath is screw-attached through sheathing to studs immediately after sheathing is installed.
- D. Vertical Installation: Install board vertical edges centered over studs. Abut ends and edges of each board with those of adjacent boards. Attach boards at perimeter and within field of board to each stud.

July 11, 2018

1. Space fasteners approximately 8 inches o.c. and set back a minimum of 3/8 inch from edges and ends of boards.
2. For sheathing under stucco cladding, boards may be initially tacked in place with screws if overlying self-furring metal lath is screw-attached through sheathing to studs immediately after sheathing is installed.

3.4 FIBERBOARD SHEATHING INSTALLATION

- A. Comply with ASTM C 846 and with manufacturer's written instructions.
- B. Fasten fiberboard sheathing panels to intermediate supports and then at edges and ends. Use galvanized roofing nails; comply with manufacturer's recommended spacing and referenced fastening schedule. Drive fasteners flush with surface of sheathing and locate perimeter fasteners at least 3/8 inch from edges and ends.
- C. Install sheathing vertically with long edges parallel to, and centered over, studs. Install solid wood blocking where end joints do not occur over framing. Allow 1/8-inch open space between edges and ends of adjacent units. Stagger horizontal joints if any.
- D. Cover sheathing as soon as practical after installation to prevent deterioration from wetting.

3.5 FOAM-PLASTIC SHEATHING INSTALLATION

- A. Comply with manufacturer's written instructions.
- B. Foam-Plastic Wall Sheathing: Install vapor-relief strips or equivalent for permitting escape of moisture vapor that otherwise would be trapped in stud cavity behind sheathing.

3.6 PARTICLEBOARD UNDERLAYMENT INSTALLATION

- A. Comply with the National Particleboard Association's recommendations for type of subfloor indicated. Fill and sand gouges, gaps, and chipped edges. Sand uneven joints flush.
 1. Fastening Method: Glue and nail underlayment to subflooring.

3.7 HARDBOARD UNDERLAYMENT INSTALLATION

- A. Comply with AHA's "Application Instructions for Basic Hardboard Products" and with hardboard manufacturer's written instructions for preparing and applying hardboard underlayment.
 1. Fastening Method: Nail underlayment to subflooring.

July 11, 2018

3.8 WEATHER-RESISTANT SHEATHING-PAPER INSTALLATION

- A. General: Cover sheathing with weather-resistant sheathing paper as follows:
 - 1. Cut back barrier 1/2 inch on each side of the break in supporting members at expansion- or control-joint locations.
 - 2. Apply barrier to cover vertical flashing with a minimum 4-inch overlap, unless otherwise indicated.
- B. Building Paper: Apply horizontally with a 2-inch overlap and a 6-inch end lap; fasten to sheathing with galvanized staples or roofing nails.
- C. Building Wrap: Comply with manufacturer's written instructions.
 - 1. Seal seams, edges, fasteners, and penetrations with tape.
 - 2. Extend into jambs of openings and seal corners with tape.

3.9 SHEATHING JOINT-AND-PENETRATION TREATMENT

- A. Seal sheathing joints according to sheathing manufacturer's written instructions.
 - 1. Apply elastomeric sealant to joints and fasteners and trowel flat. Apply sufficient quantity of sealant to completely cover joints and fasteners after troweling. Seal other penetrations and openings.
 - 2. Apply glass-fiber sheathing tape to glass-mat gypsum sheathing board joints, and apply and trowel silicone emulsion sealant to embed entire face of tape in sealant. Apply sealant to exposed fasteners with a trowel so fasteners are completely covered. Seal other penetrations and openings.
 - 3. Apply sheathing tape to joints between foam-plastic sheathing panels and at items penetrating sheathing. Apply at upstanding flashing to overlap both flashing and sheathing.

3.10 FLEXIBLE FLASHING INSTALLATION

- A. Apply flexible flashing where indicated to comply with manufacturers written instructions.
 - 1. Prime substrates as recommended by flashing manufacturer.
 - 2. Lap seams and junctures with other materials at least 4 inches, except that at flashing flanges of other construction, laps need not exceed flange width.
 - 3. Lap flashing over weather-resistant building paper at bottom and sides of openings.
 - 4. Lap weather-resistant building paper over flashing at heads of openings.
 - 5. After flashing has been applied, roll surfaces with a hard rubber or metal roller to ensure that flashing is completely adhered to substrates.

July 11, 2018

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3.11 PROTECTION

- A. Paper-Surfaced Gypsum Sheathing: Protect sheathing by covering exposed exterior surface of sheathing with weather-resistant sheathing paper securely fastened to framing. Apply covering immediately after sheathing is installed.

End of Section

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Section 06 16 73
AIR BARRIER FACED SHEATHING

PART 1 – GENERAL

1.1 GENERAL PROVISIONS

- A. The BIDDING REQUIREMENTS, CONTRACT FORMS, and CONTRACT CONDITIONS as listed in the Table of Contents, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. Furnish and install the following:
 - 1. Exterior sheathing board with factory pre-applied air and vapor barrier.
 - 2. Air barrier joint sealing tape (as component of manufacturer's system)
 - 3. Field-applied spray air barrier (as component of manufacturer's system).

1.3 RELATED REQUIREMENTS

- A. Section 06 10 00 - ROUGH CARPENTRY: Wood framing, blocking and nailers.
- B. Section 07 21 00 - THERMAL INSULATION: Wall insulation between framing.

1.4 REFERENCES

- A. Referenced Standards: Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. The standards referenced herein are included to establish recognized minimum quality only. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern. Equivalent quality and testing standards will be acceptable, subject to their timely submission, review and acceptance by the Architect.
 - 1. AAMA 711 Voluntary Specification for Self Adhering Flashing Used for Installation of Exterior Wall Fenestration Products
 - 2. ASME B18.6.1 - Wood Screws (Inch Series)
 - 3. ASTM A153/A153M - Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
 - 4. ASTM C 646 - Steel Drill Screws for the Application of Gypsum Sheet Material to Light Gage Steel Studs.
 - 5. ASTM C1289 - Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board.
 - 6. ASTM D1621 - Test Method for Compressive Properties Of Rigid Cellular Plastics.
 - 7. ASTM D2247-Standard Practice for Testing Water Resistance of Coatings in 100 % Relative Humidity

8. ASTM D3330-Standard Test Method for Peel Adhesion of Pressure-Sensitive Tape
9. ASTM D5651-Standard Test Method for Surface Bond Strength of Wood-Base Fiber and Particle Panel Materials
10. ASTM D779 - Test Method for Water Resistance of Paper, Paperboard, and Other Sheet Materials by the Dry Indicator Method.
11. ASTM E1233-Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights, and Curtain Walls by Cyclic Air Pressure Differential
12. ASTM E2357 - Standard Test Method for Determining Air Leakage of Air Barrier Assemblies
13. ASTM E331-Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference
14. ASTM E72-Standard Test Methods of Conducting Strength Tests of Panels for Building Construction
15. ASTM E84- Standard Test Method for Surface Burning Characteristics of Building Materials
16. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials
17. ASTM F1667 - Specification for Driven Fasteners: Nails, Spikes, and Staples.
18. ASTM G154 - Practice for Operating Fluorescent Light Apparatus for UV Exposure of Nonmetallic Materials.
19. DOC PS 2 - Performance Standard for Wood-Based Structural Panels.
20. Pressure Sensitive Tape Council (PSTC):
 - a. PSTC 101 Peel Adhesion of Pressure Sensitive Tapes
 - b. PSTC 131 Breaking Strength and Elongation of Pressure Sensitive Tapes

B. Definitions:

1. "Huber": Huber Engineered Woods, Charlotte, NC.
2. "GP" : Georgia-Pacific Wood Products LLC.
3. "USG/Tremco": United States Gypsum Company, Chicago, IL, and Tremco Inc. (an RPM Company), Beachwood OH (USG/Tremco)

1.5 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. General: Coordinate the work of this Section with the respective trades responsible for installing interfacing and adjoining work for proper sequence of installation, and ensure that the work performed hereunder is acceptable to such trades for the installation of their work.

B. Scheduling:

1. Do not install sheathing until all pipes, ducts, conduits, and other such items which are to be enclosed thereby, have been permanently installed, inspected and approved.

July 11, 2018

1.6 SUBMITTALS

- A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
 - 1. Product Data: Manufacturer's product data sheets, specifications, performance data, physical properties for each item furnished hereunder.
 - 2. Shop Drawings: Details of any special conditions associated with fireproofing.

1.7 QUALITY ASSURANCE

- A. General: Notify the Architect where conflicts apply between referenced standards and existing materials, and existing methods of construction.

1.8 DELIVERY, STORAGE AND HANDLING

- A. Delivery and Acceptance Requirements:
 - 1. Do not deliver items to the site, until all specified submittals have been submitted to, and approved by, the Architect.
 - 2. Deliver materials in original unopened packages, containers or bundles bearing brand name, and identification of manufacturer, with labels and package seals intact and legible.
- B. Storage and Handling Requirements:
 - 1. Store and handle materials following manufacturer's recommended procedures, and in accordance with material safety data sheets.
 - 2. Protect materials from damage due to moisture, direct sunlight, excessive temperatures, surface contamination, corrosion and damage from construction operations and other causes.
 - a. Neatly stack board materials flat to prevent sagging.

1.9 WARRANTY

- A. General: Submit warranties under provisions of Section 01 78 00 – PROJECT CLOSEOUT.
- B. Manufacturer Warranty:
 - 1. Sheathing manufacturer's 5 year limited warranty covering materials commencing on date of Project Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design (Specified Combination Sheathing Air Barrier System): To establish a standard of quality, design and function desired, Drawings and specifications have been based on Huber Engineered Woods, Charlotte, NC, product: "ZipSystem.
- B. Acceptable Manufacturers and Combination Sheathing Air Barrier Systems: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:

July 11, 2018

1. Huber Engineered Woods, Charlotte, NC, (Huber) product: "ZipSystem.
2. Georgia-Pacific Wood Products LLC, (GP) product" ForceField Weather Resistive-Barrier OSB.
3. United States Gypsum Company, Chicago, IL, and Tremco Inc. (an RPM Company), Beachwood OH (USG/Tremco), product: "Securock ExoAir 430 Panel."

2.2 PERFORMANCE CRITERIA

A. Performance Requirements.

1. Air barrier assembly air leakage: Less than 0.04 cfm/sq. ft. at 1.57 lbf/sq. ft. (0.2 L/s x sq. m at 75 Pa), per ASTM E 2375.
2. Water vapor permeance, Facer: Minimum 12 perms (689 ng/Pa x s x sq. m), ASTM E 96/E 96M.
3. Weather exposure: Manufacturer warranty applies for maximum allowable exposure period of 180 days.

B. Certifications:

1. Code Compliance:
 - a. NES NER-272 for power-driven fasteners.
 - b. International Code Council (ICC), ICC-ESR1474.
 - c. International Code Council (ICC), ICC-ESR2227.
2. Fire-Test-Response Characteristics: For assemblies with fire-resistance ratings, provide materials and construction identical to those of assemblies tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.
 - a. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory."

2.3 WALL SHEATHING

A. Oriented-Strand-Board Wall Sheathing (Huber and GP) with integral water-resistive barrier, Exposure 1; wall sheathing.

1. Span Rating: Not less than 24/16.
2. Nominal Thickness: Not less than 7/16 inch (11.1 mm).
3. Edge Profile: "Self-spacing" profile to maintain 1/8 inch gap between adjacent panel edges.
4. Provide fastening guide on top panel surface with pre-spaced fastening symbols for 16-inches (406 mm) and 24-inches (610 mm) on centers spacing.
5. Integral Water-Resistive Barrier: Medium-density phenolic-impregnated kraft paper overlay.
6. Perm Rating of Integral Water-Resistive Barrier: 12-16 perms.
7. Perm Rating of OSB Substrate in Combination with Integral Water-Resistive Barrier: 2-3 perms.

B. Fiber-glass faced Sheathing Board (USG/Tremco): 1/2 inch thick gypsum sheathing board complying with ASTM C 1177 with fiberglass mat surface front

and back with silicone-treated gypsum core conforming with the following requirements:

Properties	Test	Results
Surfacing:		Glass mat
Width:		4'-0" nominal
Length:		10'-0" (+/- 1/4 inch) maximum
Flexural Strength, lb/ft parallel (4'-0" weak direction):	ASTM C 473	80 pounds
Humidity Deflection, (inches):	ASTM C 473	1/4 inch, maximum
Linear Expansion with Change Moisture (in/in % RH):	ASTM C 518	6.25 x 10 ⁻⁶ , maximum
Thermal resistance "R" (in/ft ² °F/Btu):	ASTM C 518	0.45, minimum
Weight (per 1,000 sq ft):	ASTM C 1177	1,900 pounds minimum
Bending Radius	ASTM C 1177	6 feet, minimum
Mold growth:	ASTM D 3273	Score 10 with no mold detected
Racking Strength, lbs/ft, dry (ultimate):	ASTM E 72	>540 pounds per foot
Surface burning characteristics:	ASTM E 84	Flame spread: 10, maximum
Permeance (ng/Pa•s•m ²):	ASTM E 96 (dry cup method)	23 perms, maximum
Combustibility:	ASTM E 136	Noncombustible
Coefficient of Thermal Expansion (in/in/°F):	ASTM E 228 modified	8.5 x 10 ⁻⁶ , maximum

C. Exterior Facer: Medium-density, phenolic-impregnated polymer-modified sheet material (or factory-spray applied membrane) meeting requirements for ASTM D779 Grade D weather-resistive barrier in accordance with ICC AC38 and AC310, with the following characteristics:

1. Water Resistance of Coatings, ASTM D 2247: Pass 14 day exposure test.
2. Moisture Vapor Transmission, ASTM E 96: Not less than 12 perms.
3. Water Penetration, ASTM E 331: Pass at 2.86 lbf/sq. ft. (137 Pa).
4. Wind Driven Rain, TAS-100: Pass.
5. Accelerated Weathering, ASTM G 154: Pass.

2.4 ACCESSORIES

- A. Fasteners: Bugle head course thread, rust-resistant, 1-1/4 inch [32mm] long, sharp point screws for applying single layer sheathing board to wood framing.
- B. Self-adhering seam and flashing tape for sheathing:
 1. Huber Zip System: Pressure-sensitive, self-adhering, cold-applied, proprietary seam tape consisting of polyolefin film with acrylic adhesive equal to Huber

July 11, 2018

Engineered Woods, Charlotte, NC, product "ZIP System Seam and Flashing Tape".

2. GP ForceField System: Pressure sensitive, coated polymeric film, equal to Georgia Pacific product "ForceField" seam tape.
 3. USG/Tremco: Self-adhering strip tape, 24 mils thickness consisting of butyl laminated to an aluminized facer with release paper, equal to USG/Tremco product "ForceField Seam Tape."
- C. Field applied fluid air barrier membrane (USG/Tremco System): Site fluid-applied synthetic polymer membrane for application to adjacent substrates, detailing, and repairs. USG/Tremco product: ExoAir 230.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verification of Conditions: Inspect all surfaces and verify that they are in proper condition to receive the work of this Section.
1. Beginning of installation means acceptance of existing substrate and project conditions.
- B. Inspect framing and other substrates; verify that they are in proper condition to receive the work of this Section.
1. Verify that surface of framing and furring members to receive sheathing does not vary more than 1/4 inch from the placement of faces of adjacent members.

3.2 INSTALLATION OF SHEATHING - GENERAL

- A. Install sheathing in strict compliance with manufacturer's recommended installation instructions and as specified here, comply with all applicable code requirements.
1. Install specified control joints where indicated on Drawings. Run vertical control joints continuously to top of wall.
 2. Install wall sheathing, in accordance with APA construction standards, using Number 8 screws or 8d ring shank nails, spaced 6 inches on centers around panel edges, and 12 inches on centers at intermediate supports. Nail to existing studs
 3. Secure sheathing with long dimension either parallel or perpendicular to wall studs with ends over firm bearing, stagger joints where possible.
- B. Do not bridge expansion joints; allow joint spacing equal to spacing of structural supports.
- C. Install panels with laminated facer to exterior. Stagger end joints of adjacent panel runs.

3.3 INSTALLATION OF AIR BARRIER ACCESSORIES - GENERAL

- A. General: Install strips, transition strips, and accessory materials according to air-barrier manufacturer's written instructions. Install strips and transition strips to form connect and seal membrane air barrier material to adjacent components of building air barrier system, including, but not limited to, roofing system air barrier, exterior fenestration systems, door framing, and other openings.

July 11, 2018

- B. Primer: Apply primer per manufacturer's installation instructions.
- C. Seal punctures, voids, and seams in strips. Patch with strips extending 6 inches (150 mm) beyond repaired areas.
- D. Connect and seal exterior wall air-barrier membrane continuously to subsequently-installed roofing-membrane air barrier, concrete below-grade structures, floor-to-floor construction, exterior glazing and window systems, glazed curtain-wall systems, storefront systems, exterior louvers, exterior door framing, and other construction used in exterior wall openings, using accessory materials.
- E. Rough Openings: Treat rough openings with a joint sealant bead in joints, followed by a base coat of air barrier membrane, install reinforcement fabric and a final top coat of air barrier membrane
- F. Seal punctures, voids, and seams in strips. Patch with strips extending 6 inches (150 mm) beyond repaired areas.
- G. Flashings: Seal top of through-wall flashings to membrane air barrier with continuous transition strips of type recommended by sheet air barrier manufacturer for type of flashing.

3.4 SITE-APPLIED FLUID APPLIED AIR BARRIER MEMBRANE (USG/TREMCO)

- A. General (USG/Tremco System ONLY): Apply site fluid-applied fluid air-barrier material at non-sheathed substrates to form a seal with strips and transition strips and to achieve a continuous air barrier according to air-barrier manufacturer's written instructions. Apply site fluid-applied fluid air-barrier material within manufacturer's recommended application temperature ranges.
- B. Membrane Air Barrier: Apply site fluid-applied fluid air barrier material in full contact with substrate to produce a continuous seal with transition strips according to membrane air barrier manufacturers written instructions.
 - 1. Vapor-Permeable Membrane Air Barrier: Total dry film thickness as recommended in writing by manufacturer to meet performance requirements, but not less than 40 mil (1.0 mm) dry film thickness, applied in one or more equal coats, roller- or spray- applied.
- C. Do not cover air barrier until it has been tested and inspected by Owner's testing agency.
- D. Correct deficiencies in or remove air barrier that does not comply with requirements; repair substrates and reapply air-barrier components.

3.5 SHEATHING JOINT TAPE TREATMENT (HUBER AND GP)

- A. General: Apply seam tape at all panel seams, penetrations, and facer defects or cracks to form continuous weathertight surface. Apply tape according to manufacturer's written instructions.
- B. Seal sheathing joints according to sheathing manufacturer's written instructions.
 - 1. Apply manufacturer's proprietary seam tape to joints between sheathing panels.

2. Utilize manufacture's tape gun or hard rubber roller provided by manufacturer to ensure tape is completely adhered to substrates.

3.6 SHEATHING JOINT LIQUID APPLIED TREATMENT

- A. Apply manufacturer's proprietary liquid applied flashing membrane where indicated to comply with manufacturer's written instructions.
 1. After flexible flashing tape has been applied, roll surfaces with a hard rubber to ensure that flashing is completely adhered to substrates.
 2. Width for Flexible Flashing: 6 inch (154.4 mm).
 3. Apply liquid-applied flashing membrane at penetrations, gaps, and cracks to form continuous weathertight surface. Apply liquid membrane according to manufacturer's written instructions. Follow manufacturer's recommendation for integration with taped seams.

3.7 CLEANING

- A. General: Clean work under provisions of Section 01 73 00 – EXECUTION.
 1. Daily clean work areas by sweeping and disposing of debris, and scraps.
 2. Upon completion of the work of this Section in any given area, remove tools, equipment and all rubbish and debris from the work area; leave area in broom-clean condition.

End of Section

Section 06 20 00
FINISH CARPENTRY

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. The BIDDING REQUIREMENTS, CONTRACT FORMS, and CONTRACT CONDITIONS as listed in the Table of Contents, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. Furnish and install:
 - 1. Interior wood trim return at windows, window stools and aprons.
 - 2. Pressure preservative treated wood framed stair at Bulkhead.
 - 3. Wood entry stair (Stair 5).
 - 4. Wood entry ramp and associated wood railings.
 - 5. Soffit vents.
 - 6. Vinyl lattice work.
- B. Backprime all exterior wood trim, interior window stools, and all wood which comes in contact with cementitious and masonry materials
- C. No attempt is made in this Section to list all elements of finish carpentry required on this project or to describe how each element will be installed. It is the responsibility of the Contractor to determine for itself the scope and nature of the work required for a complete installation from the information provided herein and in the Drawings.

1.3 RELATED REQUIREMENTS

- A. Section 06 10 00 - ROUGH CARPENTRY: Wood blocking, framing, curbs, nailers, and backer boards.
- B. Section 06 40 00 - ARCHITECTURAL WOODWORK:
 - 1. Furnishing and installing cabinetry, plastic laminated shelving, and other built-in-place furniture.
 - 2. Plastic laminated countertops.
- C. Section 07 92 00 - JOINT SEALANTS: Sealant and backing materials, for joints between casework, countertops and abutting surfaces.
- D. Section 09 22 16 - NON-STRUCTURAL METAL FRAMING: Metal framing for drywall construction work, and attachment.

- E. Section 09 29 00 - GYPSUM BOARD: Drywall construction work having taped and compounded finish.
- F. Section 09 91 00 - PAINTING: Field applied primer (excluding back priming) and finish coatings.

1.4 REFERENCES

- A. Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
 - 1. ANSI A250.11 (formerly SDI 105) - Recommended Erection Instructions for Steel Doors and Frames.
 - 2. APA - applicable grades and specifications.
 - 3. ASTM D-6662 – Polyolefin-Based Plastic Lumber Decking Boards.
 - 4. FS MM-L-736 - Lumber; Hardwood
 - 5. PS-1 - Construction and Industrial Plywood.
 - 6. PS-20 - American Softwood Lumber Standard.
 - 7. SDI 122 - Installation and Troubleshooting Guide for Standard Steel Doors and Frames.
 - 8. SPIB Grading Rules, current edition.
 - 9. U.S. Department of Commerce Simplified Practice Recommendation R-16, for sizes and use classifications of lumber
 - 10. American Lumber Standards Committee, National Lumber Grades Authority for Canadian Lumber, and applicable grading rules and standards of the various lumber associations whose species are being used for grades specified.
 - 11. AWPA C-20 - Structural Lumber Fire Retardant Treatment by Pressure Processes.
 - 12. AWPA C-27 - Plywood, Fire Retardant Treatment by Pressure Processes.
 - 13. UL Building Materials Directory.
- B. Inclusionary References: The following reference materials are hereby made a part of this Section by reference thereto:
 - 1. AWI/AWMA/WI joint publication: *North America Architectural Woodwork Standards*, version 3.1, as amended by published errata, referenced herein as NAAWS.
- C. Definitions:
 - 1. AWI: American Woodwork Institute
 - 2. AWMA: Architectural Woodwork Manufacturers Association of Canada, Alberta, Canada
 - 3. WI: Woodwork Institute.
 - 4. NAUF: No added Urea Formaldehyde.

1.5 SUBMITTALS

- A. Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
1. Literature: Manufacturer's product data sheets, specifications, performance data, installation instructions for hardware, adhesives and accessories furnished hereunder.
 2. Certification:
 - a. Certify that all composite wood and agrifiber products used on this Project are NAUF.
 - 1) Written certification from Millworker, that only "no-added formaldehyde" (NAUF) manufactured composite panel products are to be incorporated into the Work, including all concealed components. NAUF composite panel products include, but are not limited to, particle board (PB), oriented strand board (OSB), and medium density fiberboard (MDF) and similar manufactured products.
 3. Shop drawings:
 - a. Large scale design details, minimum 1-1/2 inch to one foot scale, showing profiles, jointing and fastening methods; and complete installation details.
 - b. Provide full scale drawings of wood trim elements required to match existing, showing all profiles and dimensions.
 - c. Provide shop drawings bearing dimensions of actual measurements taken at the project.
 4. Samples: Provide samples as requested by Architect for selection of colors and finishes.

1.6 QUALITY ASSURANCE

- A. Quality Standards: All materials, workmanship and finishes shall meet AWI/AWMAC/WI *Architectural Woodwork Standards*, 2nd. Edition, as amended by published errata, for the following Quality Grades:
1. All work to receive transparent finishes: *Architectural Woodwork Standards*, Premium Grade.
 2. All work to receive shop-applied opaque finishes: *Architectural Woodwork Standards*, Premium Grade.
 3. All work to receive field-applied painted (opaque) finishes: *Architectural Woodwork Standards*, Premium Grade.
- B. Discard lengths of material which are unsound, warped, bowed, twisted, improperly treated, not adequately seasoned or too small to fabricate work with minimum of joints or optimum jointing arrangements, or which are of defective manufacture with respect to surfaces, sizes or patterns.

1.7 DELIVERY STORAGE AND HANDLING

- A. Do not deliver interior finish carpentry materials to the project until all concrete, masonry, plaster, and other wet work has been completed and dry.

July 11, 2018

- B. Ship and handle all materials and fabricated items in a manner which will prevent damage thereto, and store all materials and fabricated items at a dry, elevated, ventilated, and protected interior location maintaining 60 degrees Fahrenheit and a maximum relative humidity of 55 percent.

1.8 SEQUENCING AND SCHEDULING

- A. Coordinate the work of this Section with the respective trades responsible for installing interfacing work, and ensure that the work performed hereunder is acceptable to such trades for the installation of their work.

PART 2 – PRODUCTS

2.1 WOOD MATERIALS – GENERAL REQUIREMENTS

- A. General: Materials, as fabricated and installed, shall comply with specified quality grades of AWI/AWMAC/WI *Architectural Woodwork Standards*.
 - 1. All board products shall be S4S, except as otherwise specified.
- B. Panel Products: Composite panel products and plywood shall be “no added urea-formaldehyde”, including all concealed components.
 - 1. Composite panel products include but are not limited to particle board (PB), Medium Density Fiberboard (MDF), wheat board and strawboard and similar manufactured products.
- C. Moisture content:
 - 1. Wood for interior use shall have a moisture content between 5 and 10 percent, when delivered to the project.
 - 2. Wood for exterior use shall have a moisture content between 9 to 15 percent, when delivered to the project.

2.2 BOARD AND PANEL MATERIALS

- A. Interior trim to receive paint (opaque finish): Wood shall be clear without knots or surface defects. and conform to AWI/AWMAC/WI “Architectural Woodwork Standards,” latest edition for specified quality grades, (as installed). Acceptable wood species are limited to the following:
 - 1. Yellow Poplar (*Liriodendron tulipifera*), Plain Sawn, clear straight-grained, C-Select or better.
 - 2. Natural Birch” Yellow Birch (*Betula alleghaniensis*), Plain Sawn.
 - 3. Natural Maple (*Acer saccharum*), Plain Sawn.
- B. Interior trim scheduled to receive transparent finish: Furnished under Section 06 40 00 – ARCHITECTURAL WOODWORK
- C. Wood thresholds: Solid red oak, plain sawn.
- D. Plywood and panel products:
 - 1. Shelving to receive paint: 3/4 inch thick Birch veneer plywood (AA) with 3/8 inch hardwood edge banding at all edges.

2. Engineered panels scheduled for opaque finish: Medium Density Fiberboard (MDF) of thickness indicated on the Drawings, conforming to ANSI A208.2, product class MD-EXT having a minimum density of 45 pounds per cubic foot (769 kg/m³).
 - a. Georgia Pacific product "Synergite".
 - b. Canfibre Group Ltd., Toronto, Ontario Canada, product: "AllGreen MR MDF".
 - c. Norbord Industries Inc., Deposit, NY, Product: "Norbord MR"
 - d. SierrePine, product "Medex NC"
 3. Particle board: Matt formed three layer medium density wood particle panel, general use grade per ANSI A 208.1 with an minimum density of 48 pounds per cubic foot, fabricated using formaldehyde free synthetic resin. Acceptable products include the following or approved equal.
 - a. Collins Pine Company (distributed through Panel Source International, Tacoma WA.), product: "PureKor Particleboard Plus"
 - b. Plummer Forest Products, Post Falls ID., product "PFP particleboard".
 - c. SierrePine Inc., Martel, CA., product "Encore SDP"
- E. Porch Decking: Composite wood-polymer boards, "ChoiceDek" as manufactured by Weyerhaeuser, or approved equal, distributed by George McQuesten Co.,. Inc., N. Billerica MA., manufactured from recycled cedar heartwood fibers and recycled post-consumer polyethylene plastics . Provide in manufacturers standard (natural) color.
1. Warranty: Manufacturer's 20 year product warranty covering warpage, splitting, rot and termites.
 2. Decking board size: Nominal 5/4 by 6 inch.

2.3 CLOSET AND SHELVING HARDWARE

- A. Metal closet rods and brackets:
1. Closet pole: 0.109 inch (92.77 mm) wall thickness steel tubing, 1-1/16 inch diameter, of custom cut lengths required for full width of closet, chrome finish.
 - a. Provide intermediate supports for span lengths greater than 48 inches.
- B. Wood closet pole and supports: Fir 1-5/16 inch diameter wood pole with metal end closet supports.
- C. Adjustable shelving, wall mounted standards and brackets:
1. Acceptable manufacturers, include the following, or approved equal:
 - a. Knape & Vogt, Grand Rapids MI.
 - b. Spur Systems International Limited.
 - c. Reeve Store Equipment Company (ReeveCo), Pico Rivera CA.
 2. Standards (uprights): 14 gage double tracked uprights, in epoxy powder-coat finish, color as selected by Architect from manufacturer's full range of colors.
 - a. Locate uprights no greater than 24 inches on center.

- D. Adjustable shelving, wall mounted standards and brackets at offices, conference rooms, and elsewhere indicated:
 - 1. Manufacturer: Rakks/Rangine Corporation, Needham MA.
 - 2. Standards (uprights): E-Style recessed wall standards.
 - 3. Brackets: 2 inch high "Style" brackets.
 - 4. Finish: Custom color powder coat as selected by the Architect.

2.4 ACCESSORIES AND HARDWARE

- A. Eave/Soffit Vents: continuous aluminum soffit vent with factory-applied powder coat finish:
 - 1. Net free area (NFVA): not less than 8.5 square inches per linear foot.
 - 2. Dimensions: nominal 2 inches wide by manufacturer's standard length.
 - 3. Color: White.
 - 4. Acceptable manufacturers/products include the following, or approved equal.:
 - a. Air Vent, Inc., model "V105".
 - b. GAF, model "LSV8W".
 - c. Famco, model "CSVA".
 - d. Stockton Products, model "SV."
- B. Glue for lamination and fabrication of wood, plywood and particle board items: Exterior Grade, phenolic resin glue.
- C. Nails:
 - 1. Nails for interior trim items: 6d and 8d coated or galvanized finish nails, except as otherwise specified herein.
 - 2. Nails for exterior trim items: 6d and 8d epoxy coated or hot dipped galvanized finish nails. Electro-plated nails are not acceptable as equal.
 - 3. Nails for decking: Stainless steel ring shank.
- D. Screws: Flat-head wood screws of the appropriate sizes, galvanized finish for interior use and stainless steel for exterior use.

3.2 INSTALLATION - DOORS AND HARDWARE

- A. Install doors in accordance with the manufacturer's recommendations, ANSI/SDI-100, ANSI A250.11, and the Door Hardware Institute recommendations.
- B. Install hardware in accordance with manufacturer's instructions and requirements of referenced organizations, and the requirements of Section 08 71 00 - DOOR HARDWARE.
 - 1. Use the templates provided by hardware item manufacturer.
 - 2. Mount hardware units at heights indicated in the following applicable publications, except as specifically indicated or required to comply with the governing regulations.
 - a. Conform to ANSI 117.1 for positioning requirements for the handicapped.

- b. "Recommended Locations for Builders Hardware for Standard Steel Doors and Frames" by the Door and Hardware Institute (DHI.)
 - c. WDMA Industry Standard I.S.1.7, "Hardware Locations for Wood Flush Doors".
 - 3. Installation of hardware shall comply with NFPA 80 and NFPA 101 requirements
 - 4. Prefit hardware before finish is applied, remove and reinstall after finish is completed. Install hardware so that parts operate smoothly, close tightly and do not rattle.
 - 5. Drill and countersink units which are not factory-prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards.
- C. Set thresholds for exterior doors in full bed of butyl-rubber or polyisobutylene mastic sealant, forming tight seal between threshold and surface to which set. Securely and permanently anchor thresholds, using countersunk non-ferrous screws to match color of thresholds (stainless steel screws at aluminum thresholds).
 - D. Tools for maintenance: All special tools packaged with hardware items shall be saved, tagged/identified as to product use, and turned over to the Owner upon completion of the Work.
 - E. Clean adjacent surfaces soiled by hardware installation.
 - F. Prior to Final Inspection make final check and adjustment of all hardware, clean operating items as necessary to restore proper function and finish of hardware.

3.3 TOLERANCES

- A. Maximum variation for wood work from true position of 1/8 inch in 8 feet for plumb and level and with a maximum of 1/16 inch offsets in adjoining surfaces intended to be flush.
- B. Maximum variation for doors and frames: Maximum diagonal distortion 1/16 inch measured with straight edge, corner to corner.

3.4 ADJUSTING

- A. Adjust doors for smooth and balanced movement.

3.5 CLEANING

- A. Daily clean work areas by sweeping and disposing of scraps and sawdust.
- B. Upon completion of the work of this Section in any given area, remove tools, equipment and all rubbish and debris from the work area; leave area in broom-clean condition.
- C. Remove protective material from pre-finished surfaces.

July 11, 2018

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3.6 PROTECTION

- A. During the operation of finish carpentry, protect the work of other trades against undue soilage and damage by the exercise of reasonable care and precautions. Repair or replace any work so damaged and soiled.

End of Section

Section 06 40 00
ARCHITECTURAL WOODWORK

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. The BIDDING REQUIREMENTS, CONTRACT FORMS, and CONTRACT CONDITIONS as listed in the Table of Contents, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. The work of this Section consists of shop fabricated millwork and architectural woodwork where shown on the Drawings, as specified herein, and as required for a complete and proper installation. Work includes, but is not limited to the following.
- B. Furnish and install the following:
 - 1. Plastic laminate casework.
 - 2. Plastic laminate countertops.
 - 3. PVC edging of plastic laminate at edges of doors, drawer fronts, casework fronts, countertops and shelving.
 - 4. Exposed blocking and blocking concealed by the work of this Section required for the installation of architectural woodwork.
 - 5. Hardware for work of this Section.
- C. Install Cabinet cylinders furnished by Section 08 71 00 - DOOR HARDWARE.
- D. Make all cut-outs within casework items as required to accommodate sinks, piping, conduit, and other mechanical and electrical work, from templates provided by the respective mechanical and electrical trades.
- E. No attempt is made in this Section to list all elements of architectural woodwork required on this project or to describe how each element will be installed. It is the responsibility of the Contractor to determine for itself the scope and nature of the work required for a complete installation from the information provided herein and in the Drawings.

1.3 RELATED REQUIREMENTS

- A. Section 05 50 00 - METAL FABRICATIONS: Supports for countertops.
- B. Section 06 10 00 - ROUGH CARPENTRY: Concealed wood blocking and nailers.
- C. Section 06 20 00 - FINISH CARPENTRY:
 - 1. Fixed wood shelving and trim.
 - 2. Installation of wood door frames furnished under this Section 06 40 00

3. Installation of wood interior and exterior trim furnished under this Section 06 40 00.
 4. Interior and exterior wood trim.
 5. Installation of panels for refrigerators.
- D. Section 06 61 16 - SOLID SURFACING FABRICATIONS:
1. Solid surfacing material countertops.
- E. Section 09 29 00 - GYPSUM BOARD: Wall board construction work, having taped and compounded joint finish.
- F. Division 22 - PLUMBING: Plumbing fixtures and piping.
- G. Division 26 - ELECTRICAL: Electrical connections for lighting.

1.4 REFERENCES

- A. Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - References. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
1. ASTM D 523 - Standard Specification for Specular Gloss.
 2. AWI Quality Certification Program.
 3. ANSI/HPVA HP-1 – American National Standard for Hardwood and Decorative Plywood.
 4. APA Grades and Specifications.
 5. National Lumber Grades Authority, American Lumber Standards, and Grading Rules and Standards of the various lumber associations whose species are being used, with grade-marks for same.
 6. U.S. Department of Commerce Simplified Practice Recommendation R-16, for sizes and use classifications of lumber; and Product Standard (PS):
 - a. PS-1 - Construction and Industrial Plywood Standard. (on 4/2016 this is still current)
 - b. PS-20 - American Softwood Lumber Standard.
 7. AWPA C-27 - Plywood, Fire Retardant Treatment by Pressure Processes.
 8. MIL L-1914OE - Lumber and Plywood, Fire Retardant Treated.
 9. UL - Building Materials Directory.
- B. Inclusionary References: The following reference materials are hereby made a part of this Section by reference thereto:
1. AWI/AWMAC/WI joint publication: *Architectural Woodwork Standards*, 2nd. Edition, as amended by published errata.
- C. Definitions:
1. AWI: American Woodwork Institute.
 2. AWMAC: Architectural Woodwork Manufacturers Association of Canada, Alberta, Canada.
 3. HPVA: Hardwood Plywood & Veneer Association.

4. WI: Woodwork Institute.
5. NAUF: No added Urea Formaldehyde.

1.5 ADMINISTRATIVE REQUIREMENTS

A. Sequencing:

1. Field Measurements: Where possible the woodwork manufacturer shall take field measurements before preparation of shop drawings and fabrication to ensure proper fitting of Work.
 - a. Allow for adjustments within specified tolerances wherever taking of field measurements before fabrication might delay Work.
2. Field dimensions which are not controlled by Project conditions: The woodwork manufacturer is responsible for details and dimensions not controlled by Project conditions and shall show on his shop drawings all required field measurements beyond his control.
 - a. The Contractor shall acknowledge the woodwork fabricator's need for accurate field dimensions prior to custom fabrication.
 - b. The Contractor and the woodwork manufacturer shall cooperate to establish and maintain these field dimensions.

B. Scheduling:

1. Coordinate the work of this Section with the respective trades responsible for installing interfacing work, and ensure that the work performed hereunder is acceptable to such trades for the installation of their work.

1.6 SUBMITTALS

A. Information and Review Submittals: Submit the following in compliance with AWI/AWMAC/WI *ARCHITECTURAL WOODWORK STANDARDS* (AWS), 1st Edition, 2009, Section 1 – Submittals. and as specified under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:

1. Product Data: Manufacturer's product data sheets, specifications, performance data, for each item furnished hereunder, including, but not limited to: Fastenings, adhesives, hardware, and accessories.
 - a. Provide additional information required for fillers and finish products: Include, chemical, functional, and environmental characteristics, limitations and special application requirements. Identify available colors, shades, and gloss.
2. Shop drawings bearing dimensions of actual measurements taken at the project, include at least the following, which are in addition to shop drawing requirements described in *Architectural Woodwork Standards*:
 - a. 1/4 inch scale elevations and plans of each casework item.
 - b. Large scale design details of minimum 1-1/2 inch to 1-foot scale, showing abutting materials, installation conditions, clearances. Show woodwork profiles, jointing and fastening methods; details of drawers and doors.
 - c. Full size or half-full size sections, showing individual components, profiles and jointing.
3. Selection Samples:

- a. Plastic laminate chips for initial color selection by Architect.
 - b. Melamine chips for initial color selection by Architect.
 - c. Chain of PVC edging materials.
 - d. Sealant material: Manufacturer's standard strips of sealant, in all available colors, for selections by the Architect.
 - e. Provide additional samples as requested by Architect for initial selection of material colors and finishes.
4. Verification Samples:
- a. 12 by 12 inch samples of wood veneer illustrating maximum range of color variations and applied transparent shop finish.
 - b. 12 inch long samples of solid hardwoods illustrating maximum range of color variations and applied transparent shop finish.
 - c. 12 by 12 inch samples of glass shelving, and glass for casework fronts.
 - d. 12 by 12 inch samples of plastic laminate (of each color required for project).
 - e. 12 inch length samples of plastic edging material (of each color required for project).
 - f. 12 by 12 inch samples of Melamine board.
 - g. One each of all cabinet hardware. (approved cabinet hardware samples will be returned to Contractor and may become part of the Work).
5. Certificates:
- a. Certify that all composite wood and agrifiber products used on this Project are NAUF.
 - 1) Written certification from Millworker, that only "no-added formaldehyde" (NAUF) manufactured composite panel products are to be incorporated into the Work, including all concealed components. NAUF composite panel products include, but are not limited to, particle board (PB), oriented strand board (OSB), and medium density fiberboard (MDF) and similar manufactured products.
6. Manufacturer's Instructions: Provide installation instructions and templates for hardware and field applied items.

1.7 QUALITY ASSURANCE

- A. Quality Standards: All materials, workmanship and finishes shall meet AWI/AWMAC/WI *Architectural Woodwork Standards*, 2nd. Edition, as amended by published errata, for "Premium" Quality Grade.
- B. Qualifications:
 1. Fabricator/Installer: AWI member specializing in architectural woodwork of type specified herein having a minimum of 5 years documented experience.

1.8 DELIVERY, STORAGE AND HANDLING

- A. Delivery and Acceptance Requirements:

July 11, 2018

1. General: The woodwork manufacturer, woodwork installer and the Contractor are jointly responsible to make certain that woodwork is not delivered until the building and storage areas are sufficiently dry so that the woodwork will not be damaged by excessive changes in ambient humidity and relative moisture content.
 2. Concrete, masonry, plaster, tile and marble setting and polishing and other wet work shall be completed and dry before delivery, storage and installation of woodwork items.
 3. Sequence deliveries to avoid delays and to minimize on-site storage.
- B. Storage and Handling Requirements:
1. Ship and handle all materials and fabricated items in a manner which will prevent damage thereto, and store all materials and fabricated items at a dry, elevated, ventilated, and protected interior location.

1.9 SITE CONDITIONS

- A. Temperature: Maintain ambient temperature above 55 degrees Fahrenheit for 5 calendar days before, and during installation of architectural woodwork; maintain temperature after installation until Owner's Final Acceptance.
- B. Relative Humidity: Maintain a relative humidity between 25 and 55 percent for a minimum period of 5 calendar days before, and during, installation of architectural woodwork: maintain relative humidity after installation until Owner's Final Acceptance.

PART 2 - PRODUCTS

2.1 WOOD MATERIALS – GENERAL REQUIREMENTS

- A. General requirements:
1. Solid wood components: New, dressed four sides (S4S), and free from warping and other defects.
 2. Panel Products: Composite panel products and plywood shall be "no added urea-formaldehyde", including all concealed components.
 - a. Composite panel products include but are not limited to particle board (PB), Medium Density Fiberboard (MDF), wheatboard and strawboard and similar manufactured products.
 3. Moisture Content:
 - a. Solid hardwood(s) scheduled for transparent finish: Moisture content shall not exceed 8 percent when delivered to Project.
 - b. Typical (hardwood and softwoods): Moisture content of wood shall be between 5 and 10 percent when delivered to the project.
- B. Concealed supports for edge and corner backing shall be kiln dried birch or poplar, meeting AWI Premium Grade Standards.
- C. Blocking and furring at base and walls shall comply with American Softwood Lumber Standard PS 20-70 and with specific grading requirements of SPIB: Kiln dried (KD15), Structural Light Framing, N°. 2 grade, free of warping and large knots.

July 11, 2018

- D. Internal concealed framing for casework: Kiln-dried, (KD15), eastern pine, poplar, eastern spruce, or southern pine, conforming to AWI Premium grade.
- E. Fir plywood for concealed from view applications in conjunction with the various casework items: APA C-C PLUGGED EXT.

2.2 PLASTIC LAMINATE FACING

- A. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
 - 1. Formica Corp., Cincinnati, OH.
 - 2. Laminart, Elk Grove Village, IL.
 - 3. Pioneer Plastics Corp. (Pionite), Auburn ME.
 - 4. Nevamar Corp., Odenton MD.
 - 5. Ralph Wilson Plastics Co. (Wilsonart), Temple TX.
- B. Plastic laminate, general purpose, conforming to NEMA LD3.1 -2005 Grade GP50, nominal 0.050 inch thickness, in a low non-directional texture in color price group selected by the Architect.
 - 1. General purpose grade laminate shall be used for all exposed to view surfaces including
 - a. Exposed outward face of cabinet fronts and closure trim.
 - b. Cabinet doors (all sides).
 - c. Drawer fronts (all sides).
 - d. Interior surfaces of open cabinets (without doors).
 - e. Plastic laminated trim.
 - 2. General purpose grade laminate shall be used for counter tops except where colored core laminate is indicated.
- C. Plastic laminate, unfinished balancing (backer) sheet, conforming to NEMA LD3-1985 undecorated laminate, Grade BK20, 0.020 inch nominal thickness.

2.3 POLYESTER LAMINATE (MELAMINE)

- A. Polyester laminate (melamine): Thermosetting acid resistant polyester resin impregnated laminate, permanently bonded to substrate.
 - 1. Polyester laminate to be 9 to 11 mils in thickness, 62% resin content, colorfast.
 - 2. The following requirements, standards and tests shall apply:
 - a. U.S. Federal: F.S.L. P-508
 - b. ASTM: D-1300-53T
 - c. U.S. Food & Drug: Section 175.300
 - d. NEMA: LQ1-1977
 - e. NEMA: LD3-1980

July 11, 2018

- B. Provide colored polyester laminate for where indicated on Drawings. Color shall be white, black, buff or grey as selected by Architect.
 - 1. Polyester laminate shall be used for the interior surfaces of all 'closed cabinets,' where general purpose grade laminate is not required.
 - 2. All cabinet shelving shall be polyester laminate.
- C. Melamine panel backing: At fabricator's option, one of the following:
 - 1. Mattformed three layer medium density wood particle panel (PB), graded M2 per ANSI A 208.1 with a minimum density of 48 pounds per cubic foot.
 - 2. Moisture resistant medium density fiberboard (MDF) conforming to ANSI A208.2 product class MD, having a minimum density of 44 pounds per cubic foot.

2.4 BACKING FOR LAMINATES AND VENEERS

- A. Cabinetry case body, and countertops without sinks: Mattformed three layer medium density wood particle panel (PB), graded M2 per ANSI A 208.1 with a minimum density of 48 pounds per cubic foot or equivalent hardwood plugged plywood complying with ANSI/HPVA HP-1.
 - 1. "No Formaldehyde Added": Provide board which is fabricated using pre-consumer recycled wood fibers and an exterior-grade urea-formaldehyde free resin binder. Product shall contain no formaldehyde additives. Acceptable products include the following or approved equal.
 - a. Collins Pine Company (distributed through Panel Source International, Tacoma WA.), product: "PureKor Particleboard Plus"
 - b. Plummer Forest Products, Post Falls ID., product "PFP particleboard".
 - c. SierrePine Inc., Martel, CA., product "Encore SDP"
 - 2. Thicknesses:
 - a. 3/4 inch thick at cases.
 - b. 1 inch thick at shelves under 30 inches wide.
 - c. 1 1/8 inch thick at shelves 30 inches or more wide.
 - d. 1 1/8 inch thick at counters without sinks.
- B. Casework end panels which extend to floor, and all countertops with sinks and similar wet conditions: Moisture resistant medium density fiberboard (MDF) conforming to ANSI A208.2 product class MD, fabricated from 100 percent pre-consumer recycled fiber, using formaldehyde free polyurethane/synthetic resin such as methyl diisocyanate (MDI) or (pMDI), having a minimum density of 44 pounds per cubic foot.
 - 1. Acceptable products include the following:
 - a. SierrePine Inc., Moncure, NC., product "Medex".
 - 2. Thicknesses:
 - a. Typical: 3/4 inch thick panels, except as otherwise indicated.
- C. Countertops with sinks and similar wet conditions: Moisture resistant medium density fiberboard (MDF) conforming to ANSI A208.2 product class MD, fabricated from 100 percent pre-consumer recycled fiber, using formaldehyde free

July 11, 2018

polyurethane/synthetic resin such as methyl diisocyanate (MDI) or (pMDI), having a minimum density of 44 pounds per cubic foot.

1. Acceptable products include the following:
 - a. SierrePine Inc., Moncure, NC., product "Medex".
 2. Thicknesses:
 - a. Typical: 3/4 inch thick panels, except as otherwise indicated.
- D. Countertops with sinks and similar wet conditions: APA C-C PLUGGED EXT, fir plywood, sanded.
- E. Drawers and doors: Medium density fiberboard (MDF) conforming to ANSI A208.2 product class MD, fabricated from 100 percent pre-consumer recycled fiber, using formaldehyde free polyurethane/synthetic resin such as methyl diisocyanate (MDI) or (pMDI), having a minimum density of 45 pounds per cubic foot.
1. Acceptable products include the following or approved equal:
 - a. Canfibre Group Ltd., Toronto, Ontario Canada, product: "AllGreen MDF".
 - b. Collins Pine Company (distributed through Panel Source International, Tacoma WA.), product: "PureKor MDF Plus"
 - c. SierrePine Inc., Martel, CA., product "Medite II"
 - d. Temple Inland, Austin TX., product "UltraStock – Free."
 2. Thicknesses:
 - a. Typical: 3/4 inch thick panels, except as otherwise indicated or specified.
 - b. Doors over 36 inches tall: provide 1-1/4 inch thick panels.

2.5 CABINET HARDWARE

- A. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
1. Accuride Corp., Santa Fe Springs, CA.
 2. CompX International, Inc., Dallas TX.
 3. Doug Mockett & Company, Inc., Manhattan Beach, CA.
 4. Engineered Products Company, Flint MI.
 5. Glynn-Johnson, Indianapolis IN.
 6. Grass America Inc., Kernersville NC.
 7. H.B. Ives Company, Wallingford CT.
 8. Häfele America Company, Archdale NC.
 9. Julius Blum, Inc. , Stanley NC.
 10. Knape & Vogt, Grand Rapids, MI.
 11. (Lamp) Sugatsune America, Inc. Carson, CA..
 12. Mepla Inc., High Point NC.
 13. Outwater Plastic Industries Inc., Bogata NJ.
 14. Stanley Hardware, New Britain CT.
 15. Waterloo Furniture Components, Ontario Canada.

- B. Door and drawer pulls: Provide manufacturer(s) and model(s) indicated on Drawings.
- C. Locks:
 - 1. General:
 - a. Provide at least three keys per keyed alike group.
 - b. Finish: lock plug finish "nickel".
 - 2. Locks for drawers and doors: deadbolt type.
 - 3. Locks for front mounted gang locks.
- D. Catches: Magnetic touch latch type.
- E. Casework (European, concealed type) hinges:
 - 1. General; number of hinges: Provide number of hinges recommended by manufacturer for size and weight of door, but not less than the following:
 - a. Doors up to 36 inches height, or weight not to exceed 11 pounds: 2 hinges.
 - b. Doors up to 60 inches height, or weight not to exceed 20 pounds: 3 hinges.
 - c. Doors up to 72 inches height, or weight not to exceed 33 pounds: 4 hinges.
 - d. Doors up to 90 inches height, or weight not to exceed 48 pounds: 5 hinges.
 - 2. Hinge for full overlay cabinet doors: Self closing concealed hinge having maximum 110 degree angle of opening, 3 way adjustment. Hinges shall be equal to Blum "Soft-Close BLUMotion Clip-Top Overlay Hinge" with straight arm, model N°. 71B3550.
 - a. Maximum door thickness 1 inch (26 mm).
 - 3. Hinge for full overlay cabinet 'thick' doors: Self closing concealed hinge having maximum 95 degree angle of opening, 3 way adjustment. Hinges shall be equal to Blum "Clip-Top Overlay Hinge" with straight arm, model N°. 71T9550 with BLUMotion 'soft-close'.
 - a. Maximum door thickness 1-3/16 inch (30 mm).
- F. Pad silencers for doors: 10 mm (3/8 inch) diameter, self-adhesive resilient plastic or nylon buttons, at least 2 per door, in clear color.
- G. Drawer Slides (provide one pair per drawer except as noted otherwise):
 - 1. For heavy loads including file drawers: Full extension type, 150 pounds per pair minimum rated capacity (for drawers over 30 inches, provide 175 pounds rated capacity), steel ball bearing rollers, drawer hold in feature.
 - a. Acceptable slides, include the following, or approved equal:
 - 1) For drawers up to 24 inches wide:
 - a) Accuride N°. 4032.
 - b) Knape and Vogt N°. 8500.
 - c) Häfele N°. 4034.
 - 2) For drawers over 24 inches and up to 30 inches wide:

- a) Accuride N°. 4032.
 - b) Knape and Vogt N°. 8500.
 - c) Häfele N°. No equal.
 - 3) For drawers over 30 inches wide:
 - a) Accuride N°. 4437.
 - b) Knape and Vogt N°. 8520.
 - c) Häfele N°. No equal.
 - b. Finish: clear lacquered zinc.
 - 2. For desk and casework drawers (excluding file drawers): Full extension type, 100 pounds per pair minimum rated capacity, steel ball bearing rollers, lever disconnect, drawer hold in detent feature.
 - a. Acceptable slides, include the following, or approved equal:
 - 1) Accuride N°. 3832A
 - 2) Knape and Vogt N°. 8400.
 - 3) Häfele N°. 3832.
 - b. Finish: clear lacquered zinc.
- H. Shelf supports.
- 1. Shelf pins for laminated shelving: plug-in type for 5mm diameter hole, Häfele model number 282.11.710 cast zinc alloy with nickel plated finish and recessed seat.
- I. Wire management grommets and covers: 3 inch diameter, as manufactured by Doug Mockett & Company, Manhattan Beach CA., model number " PS-3B with cover".
- 1. Grommet Finish: Provide in Satin Chrome (26D) finish, except as otherwise selected by Architect for designated locations. Grommet finishes as selected from Manufacturer's standard finishes.
 - 2. Locations: Provide where shown on Drawings, and if not shown, allow the following numbers of grommets; exact locations to be determined in field.
 - a. For counters 6 feet or less provide 2 wire grommets and covers.
 - b. For counters over 6 feet, provide 1 wire grommet and cover for every 42 inches of counter, or fraction thereof.
 - 3. Locations: Provide where shown on Drawings, and if not shown, allow the following numbers of grommets; exact locations to be determined in field.
 - a. For counters 6 feet or less provide 2 wire grommets and covers.
 - b. For counters over 6 feet, provide 1 wire grommet and cover for every 42 inches of counter, or fraction thereof.

2.6 ACCESSORIES

- A. PVC Edging for plastic laminate casework:
- 1. Manufactured by The Cloverdale Company (Band-it Brand), Cloverdale VA., or equal.
 - 2. Thickness: 2mm thick for door and drawer edges; 1mm for exposed edges of casework bodies.
 - 3. Edges: Square.

July 11, 2018

4. Custom colors to match plastic laminate colors.
- B. Adhesive for installation of plastic laminate: Rigid bond Polyvinyl acetate (PVA) type only.
1. Contact cements are only permitted at countertops with sinks or similar "wet condition" areas; and field installed applications as required.
- C. Glue for lamination and fabrication of wood and plywood items: Exterior Grade, phenolic resin glue.
- D. Counter support brackets:
1. Construction: Fabricated from horizontal aluminum T section and vertical aluminum L section. Vertical leg designed to attach to side of supporting stud and be concealed by gypsum board or other wall finish. Alternative manufacturers provide equivalent sized steel T-sections and shop finishing.
 - a. Bracket sizes:
 - 1) For up to 18 inch deep counters: 12 by 12 inch length legs
 - 2) For up to 24 inch deep counters: 18 by 18 inch length legs.
 - 3) For up to 30 inch deep counters: 18 inch vertical leg and 24 inch length horizontal leg.
 2. Basis of Design: Rakks Flush Mount Counter Supports by Rakks/Rangine Corp, Needham MA.
 - a. Acceptable Manufacturers/products, or approved equal:
 - 1) Rakks Flush Mount Counter Supports by Rakks/Rangine Corp, Needham MA, with powder coat finish.
 - 2) Outwater LLC., Woodridge NY. "South Carolina" Series: CSBxx-SC-CRS with powder coat finish.
 - 3) Federal Brace, Belmont NC., model "Streamline Countertop Bracket (steel). Requires separate shop finishing by this Section 06 40 00.
 3. Factory applied finishes: Exposed aluminum surfaces shall be free of scratches and other serious blemishes and be factory finished with:
 - a. Primer suitable for field painting.
- E. Sealant, for joints between countertops and dissimilar materials: One component acetoxysilicone rubber, mildew resistant, FS TT-S-001543A, Type Non-Sag, Class A, and FS TT-S-00230C, Type II, Class A and ASTM C 920, Type S, Class 25, Grade NS, use NT,G and A with a minimum movement capability of ± 25 percent, and a Shore A hardness of 20, in manufacturer's standard colors as selected by the Architect.
1. Only use sealant and primers that comply with the following limits for VOC content:
 - a. Architectural Sealants: 250 g/L.
 - b. Sealant primer: 250 g/L
 2. Sealants containing aromatic solvents, fibrous talc, formaldehyde, halogenated solvents, mercury, lead, cadmium, chromium and their compounds, are not permitted.
 3. Subject to requirements specified herein, the following products are acceptable, or approved equal:

- a. Dow Corning Corporation, Midland MI.; product, "786".
- b. General Electric Company, Waterford NY.; product, "Sanitary 1700".
- c. Sonneborn Building Products Inc., Minneapolis MN.; product, "Sonolastic - OmniPlus".
- d. Tremco, Beachwood OH.; product, "Proglaze".

F. Fasteners:

1. Concealed joint fasteners: Threaded steel.
2. Bolts, nuts, washers, lags, pins, and screws: Of size and type to suit application chrome finish in exposed-to-view locations.

2.7 FABRICATION - GENERAL

- A. Do not fabricate materials until all specified submittals have been submitted to, and approved by, the Architect.
- B. Coordinate the fabrication of casework with that of the various trades responsible for installing materials and items which will be inserted into, or applied to, the casework surfaces. Obtain and verify templates, dimensions, and instructions from the respective trades before making cut-outs, holes, slots, and other cutting in the casework.
- C. Shop assemble custom casework for delivery to site. Deliver in assemblies as large as possible for entrance into the designated areas. Provide for concealed job connections of adjacent units.
- D. Prepare woodwork in the shop for all necessary electrical installations.
- E. Fabricate, install and finish all work so that both sides of countertops, panels, doors, shelves and other casework are of balanced construction, to prevent warping.
- F. Cap exposed plywood, and particle board edges.
- G. Fit corners and joints hairline, secure with concealed fasteners.
- H. Finish all solid wood and plywood surfaces smooth, and free from all machine and tool marks that will show through facing materials.
- I. Make all joints tight, and form to conceal shrinkage. Glue all miters having a dimension of 4 inches or more from heel to point.
- J. Provide shop fabricated counters, shop mitered components, closure trims with ample allowance for field cutting and fitting. Provide additional trim as required for scribing and site cutting.
- K. Finished work shall be free from visible adhesive and pencil marks.

2.8 FABRICATION - CASEWORK

- A. Fabricate casework in accordance with requirements of AWI/AWMAC/WI "*Architectural Woodwork Standards*," latest edition, in grades specified herein,

under the Article entitled "QUALITY ASSURANCE," and the following additional requirements:

1. Cabinets shall be in flush overlay construction, with drawer fronts and hinged doors overlapping openings a minimum of 1/4 inch all four sides.
2. Fabricate cabinets in integral units, each completely enclosed, without the use of common partitions.
3. Fabricate plastic laminated casework with top and bottom fillers and corner panels described as optional for Custom Grade Work in the Quality Standards.
4. Drawers:
 - a. Laminated drawer fronts: High density laminate over 3/4 inch specified core material. Drawer fronts shall be applied to separate drawer body component sub-front.
 - b. Drawer bottoms (plastic laminated casework): 1/4 inch thick color polyester laminate, housed and glued into front, sides and back.
 - c. Underside of drawer to receive continuous hot melt glue at joint between bottom and back/sides/front for sealing and rigidity.
 - d. Reinforce drawer bottoms as required with intermediate spreaders.
5. Doors: Square edge design, 3/4 inch thick, without any profiling and shall fully overlap the cabinet frame.
 - a. Laminate doors: Fabricate doors with particle board core and front and rear faces high-pressure laminate, of selected color.
 - b. Maintain a maximum 1/8" reveal between pairs of doors, between door and drawer front, or between multiple drawer fronts within the cabinet.
6. Base cabinets: Provide full horizontal top frame with glued and doweled joints, 3/4 inch plywood end panels and bottom. Bottom shall be glued and doweled and let into routed end panels. Provide 4 inch high toe rail, securely screwed to the end panels and to the bottom panel by concealed glue blocks.
7. Wall cabinets: Provide same finishes as base cabinets, with 3/4 inch thick top and bottom veneered plywood panels. Top and bottom panels shall be glued and doweled and let into routed end panels. Back of case shall be recessed and let into routed end panels and further secured with glue blocks.
8. Door and drawer spreaders: Provide minimum 3/4 thick full width cabinet body spreaders immediately behind all door/drawer and multiple drawer horizontal joints to maintain exact body dimensions, and close off reveal. Front edge to be match face of adjacent cabinet doors/drawers.

2.9 FABRICATION OF PLASTIC LAMINATE CLAD ITEMS

- A. Do not fabricate materials until all specified submittals have been submitted to, and approved by, the Architect.
- B. Except as otherwise specified hereunder, fabricate plastic laminate clad items in strict accordance with the details on the Drawings, the approved shop drawings, and workmanship standards set forth in AWI/AWMAC/WI "*Architectural Woodwork Standards*," latest edition, in grade(s) specified herein.

July 11, 2018

- C. Shop fabricate all plastic laminate clad items. Adhere plastic laminate to particle board backing sheets by cold-press-method. Use of contact cements are not permitted. Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Apply laminate backing sheet to reverse side of all laminated, panels, shelving and tops.
- D. Cap edges with specified banding, matching color of plastic laminate panels.
 - 1. Casework facing: Machine apply flat PVC banding, 0.018 inch (0.050 mm), using waterproof hot melt adhesive.
 - 2. Drawer and door fronts: Machine apply to all four edges, 2mm thick PVC banding, using waterproof hot melt adhesive, corner radiused profile for consistent design and safety.
 - 3. Shelving: Machine apply to all four edges, 2mm thick PVC banding, using waterproof hot melt adhesive, corner radiused profile for consistent design and safety.
- E. Fit corners and joints hairline. Make all joints and miters tight, secure with concealed fasteners.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verification of Conditions: Inspect all surfaces and verify that they are in proper condition to receive the work of this Section.
 - 1. Verify adequacy of blocking, backing and support framing for all finish carpentry work.
 - 2. Examine pre-fabricated woodwork before installation and verify that back priming has been completed and all packing has been removed.
 - 3. Beginning of installation means acceptance of existing substrate and project conditions.

3.2 PREPARATION

- A. Before installing work under this section, woodwork shall be conditioned to average prevailing humidity conditions in areas of installation.
- B. Protect other Work against undue soilage and damage by the exercise of reasonable care and precautions. Clean, repair, or replace any work so damaged and soiled to the acceptance of the Architect.

3.3 INSTALLATION - GENERAL

- A. Install work in accordance with the latest AWI/AWMAC/WI joint publication: *Architectural Woodwork Standards* in grade specified herein, under the Article entitled "QUALITY ASSURANCE".
- B. Woodwork shall be installed plumb, level, true and straight without distortions.
 - 1. Use concealed shims as required
 - 2. Work shall be installed to a tolerance of 1/8 inch in 8 feet for plumb and levelness, including tops.

- 3. There shall be no variations in flushness of adjoining surfaces.
 - C. Tops and woodwork shall be scribed and trimmed to fit adjoining work.
 - 1. Where cuts occur, refinish surfaces and repair damaged finishes
 - D. Secure woodwork to anchors or built-in blocking or blocking directly attached to substrates.
 - 1. Secure woodwork to grounds, furring, stripping and blocking as required with countersunk, concealed fasteners and blind nailing performing a complete installation.
- 3.4 INSTALLATION - CASEWORK AND COUNTERTOPS
- A. Install casework without distortion so that doors and drawers fit openings properly and are accurately and evenly aligned.
 - 1. Install end cabinet panels with a continuous bead of Sealant Type SL applied to bottom edge that abuts finish flooring. Immediately remove all excess sealant from surfaces of the casework and flooring.
 - B. Adjust casework hardware centering the doors and drawers in the openings, and provide unencumbered operation.
 - C. Complete the installation of hardware and accessory items as indicated.
 - D. Tops: Anchor tops securely to base units and to other support systems as required.
 - E. Install back and side splashes with a continuous bead of Sealant Type SL applied to splash edges that abut countertop materials and adjoining splashes. Immediately remove all excess sealant from surfaces of the casework.
- 3.5 TOLERANCES
- A. Maximum variation from true position 1/16 inch with a maximum of 1/32 inch offset from true alignment with adjoining surfaces intended to be flush.
- 3.6 ADJUSTING
- A. To whatever extent work was not completed at shop or prior to installation of woodwork, perform and complete the specified finishing of woodwork.
 - B. Repair damaged and defective woodwork where possible eliminating defects functionally and visually.
 - 1. Where not possible to repair damaged or defective work, replace with matching new work.
 - 2. Adjust joinery for uniform appearance.
 - C. Adjust doors and drawers for smooth and balanced movement, lubricate hardware for use.

July 11, 2018

3.7 CLEANING

- A. Comply with requirements of Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL for handling and disposition of all construction and demolition waste.
- B. Daily clean work areas by sweeping and disposing of scraps and sawdust.
- C. Upon completion of the work of this Section in any given area, remove tools, equipment and all rubbish and debris from the work area leave area in broom-clean condition.
- D. Clean excess sealant by moderate use of mineral spirits or other solvent acceptable to sealant manufacturer.
- E. Remove protective material from pre-finished surfaces, immediately prior to Final Acceptance.
- F. Carefully clean exposed and semi-exposed wood surfaces, in strict accordance with fabricator's instructions. Touch-up shop-applied finishes to restore damaged or soiled areas, matching adjoining finish.
- G. Wash down plastic laminate with a solution of mild detergent in warm water, applied with soft clean wiping cloths. Take care to remove dirt from corners. Wipe surfaces clean.
- H. Clean and polish hardware, and bright metal trim components.

3.8 PROTECTION

- A. Protect installed woodwork and maintain specified conditions, in a manner acceptable to both fabricator and installer. Ensure that work of this Section will not be damaged or soiled, and is completely free of defects at the time of final acceptance of Project by the Architect.

End of Section

Section 06 60 00
PLASTIC FABRICATIONS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. The BIDDING REQUIREMENTS, CONTRACT FORMS, and CONTRACT CONDITIONS as listed in the Table of Contents, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. Furnish and install:
 - 1. Column covers

1.3 RELATED REQUIREMENTS

- A. Section 06 10 00 - ROUGH CARPENTRY: Wood blocking, framing, curbs, nailers, and backer boards.
- B. Section 06 20 00 - FINISH CARPENTRY:
 - 1. Exterior trim.
 - 2. Interior wood trim.
- C. Section 06 40 00 - ARCHITECTURAL WOODWORK:
 - 1. Furnishing and installing cabinetry, plastic laminated shelving, and other built-in-place furniture.
 - 2. Plastic laminated countertops.
- D. Section 07 92 00 - JOINT SEALANTS: Sealants.
- E. Section 09 91 00 - PAINTING: Field applied primer (including backpriming) and finish coatings.

1.4 REFERENCES

- A. Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
 - 1. ASTM D638 – Tensile Properties of Plastic.
 - 2. ASTM D695 – Compressive Strength of Rigid Plastics.
 - 3. ASTM D790 – Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
 - 4. ASTM E84 – Surface Burning Characteristics of Building Materials.

July 11, 2018

1.5 SUBMITTALS

- A. Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
1. Literature: Manufacturer's product data sheets, specifications, performance data, installation instructions for adhesives and accessories furnished hereunder.
 2. Shop drawings:
 - a. Large scale design details, minimum 1-1/2 inch to one foot scale, showing profiles, jointing and fastening methods; and complete installation details.
 - b. Provide full scale drawings of trim elements required to match existing, showing all profiles and dimensions.
 - c. Provide shop drawings bearing dimensions of actual measurements taken at the project.
 3. Samples: Provide samples as requested by Architect for selection of colors and finishes.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Do not deliver interior finish carpentry materials to the project until all concrete, masonry, plaster, and other wet work has been completed and dry.

1.7 SEQUENCING AND SCHEDULING

- A. Coordinate the work of this Section with the respective trades responsible for installing interfacing work, and ensure that the work performed hereunder is acceptable to such trades for the installation of their work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Specified Manufacturer: To establish a standard of quality, design and function desired, Drawings and specifications have been based on Melton Classics Inc., Lawrenceville GA., Product: "FRP Classic."
- B. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
1. Melton Classics Inc., Lawrenceville GA.
 2. Edon Corp., Horsham PA.
 3. DEC Architectural Composites, Anaheim CA.
 4. Fibertech Corporation, Pendleton SC.
 5. Vista FRP Products, Ltd., Ajax Ontario Canada
 6. Somerset Door and Column Company, Somerset PA.

2.2 MATERIALS

- A. Glass cloth, matt and "chop" shall be equal to the products of PPG-Owens Corning.

- B. Molded Exterior Surface (Gel-coat): ultra-violet light inhibited, NPG-SIO polyester gel coat 15 to 25 mils thickness.
- C. Back-up laminate:
 - 1. Resin: Fire retardant Isophthalic Polyester Resin, ASTM E-84, Class 1 rated.
 - 2. Fiberglass reinforcement:
 - a. "E" type fiberglass
 - b. Random chopped glass fibers.
 - 3. Glass content: Nominally 25 to 30 percent, except 15 percent for filled resin systems.
 - 4. Laminate thickness: Nominal 3/16 inch.
 - a. Provide additional thickness and reinforcement and sandwich systems as required for structural integrity of all components furnished under this Section.
- D. Internal metal reinforcement, anchorage clips and brackets: Provided as required by structural design. All hardware and built-in items shall be type 302/304 stainless steel.

2.3 ACCESSORIES AND HARDWARE

- A. Bolts, nuts, washers, blind fasteners: stainless steel, of size and type to suite application as indicated in the drawings.

2.4 FABRICATION

- A. Fabrication: Manufactured using specified resins, reinforced with chopped glass fibers. All exposed surfaces shall be finished with colored gel-coat with UV inhibitor.
- B. Fabricated ratio of non-metal materials: 25 percent fiber and 75 percent resin.
- C. Tolerances:
 - 1. Part thickness: plus or minus 1/16 inch.
 - 2. Gel coat thickness: plus or minus 2.5 mils.
 - 3. Length: plus or minus 1/8 inch.
 - 4. Variation from square: 1/8 inch.
 - 5. Hardware/Fastener location variation: plus or minus 1/4 inch.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify adequacy of blocking, backing and support framing for all finish carpentry work.
- B. Beginning of installation means acceptance of existing substrate and site conditions.

July 11, 2018

3.2 INSTALLATION - GENERAL

- A. Finished work shall be dressed and sanded until free from machine and tool marks, abrasions, raised grain, or other defects that will show through the finish on surfaces exposed to view. Carry out this sanding on a shop belt sander, not in the field. Sandpaper field joints and leave in perfect condition for finishing.
- B. Make all joints tight, and form to conceal shrinkage. Glue all miters having a dimension of 4 inches or more from heel to point. Joints shall be glued tight and so formed as to conceal shrinkage. Cope trim at returns and miter at corners to produce tight-fitting joints with full surface contact throughout length of joint.
- C. Make a minimum of splices and joints in running trim, and where such splices and joints occur, fasten securely, with all exposed surfaces having smooth, continuous planes. Stagger joints in adjacent or relate members. Use scarf joints for end-to-end joints.
- D. Scribe and cut work to fit adjoining work closely. Refinish cut surfaces in prefinished items.
- E. All nails in interior finished work shall be blind nailed wherever possible. Nail trim with finish nails only, set using appropriate nailpunch and fill with matching wood filler. Sand smooth wood filler. Do not fasten trim with screws or bolts unless otherwise directed, or is to be subsequently covered with smaller trim.
- F. Work shall be properly framed, closely fitted and accurately set to the required lines and levels and shall be rigidly secured in place. Shim as required using concealed shims to achieve specified tolerances.

3.3 TOLERANCES

- A. Maximum variation for plastic fabrications work from true position of 1/8 inch in 8 feet for plumb and level and with a maximum of 1/16 inch offsets in adjoining surfaces intended to be flush.

End of Section

Section 06 61 16
SOLID SURFACING FABRICATIONS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. The BIDDING REQUIREMENTS, CONTRACT FORMS, and CONTRACT CONDITIONS as listed in the Table of Contents, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. Furnish and install the following:
 - 1. Solid surface (solid polymer) countertops .
 - 2. Sealant, for joints between countertops, backsplashes and abutting surfaces.
- B. Make all cut-outs within solid surfacing items as required to accommodate sinks, and other plumbing fixtures, from templates provided by the respective trades.

1.3 RELATED REQUIREMENTS

- A. Section 06 10 00 - ROUGH CARPENTRY: Wood blocking and nailers.
- B. Section 06 40 00 - ARCHITECTURAL WOODWORK: Cabinetry, shelving and other shop fabricated casework.
- C. Division 22 - PLUMBING: Plumbing fixtures and piping.

1.4 SUBMITTALS

- A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
 - 1. Literature: Manufacturer's product data sheets, specifications, performance data. Identify available colors, shades, and gloss
 - 2. Shop drawings: Large scale design details of minimum 1-1/2 inch-to-1 foot scale, showing abutting materials, installation conditions, clearances. Show profiles, jointing and fastening methods.
 - 3. Selection samples:
 - a. Solid surfacing samples for initial color selection by Architect.
 - b. Sealant material: Manufacturer's standard strips of sealant, in all available colors, for selections by the Architect.
 - c. Provide additional samples as requested by Architect for initial selection of material colors and finishes.
 - 4. Verification samples:
 - a. 12 by 12 inch samples of solid surfacing materials.

July 11, 2018

1.5 QUALITY ASSURANCE

- A. Fabricator and Installer; with a minimum of 3 years documented experience demonstrating previously successful work of the type specified herein, and approved by product manufacturer.
 - 1. Fabricator and Installer for solid surfacing products shall be trained and certified by solid surfacing manufacturer.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Concrete, masonry, plaster, tile and marble setting and polishing and other wet work shall be completed and dry before delivery, storage and installation of fabricated solid surface items.
- B. Ship and handle all materials and fabricated items in a manner which will prevent damage thereto, and store all materials and fabricated items at a dry, elevated, ventilated, and protected interior location.
- C. Sequence deliveries to avoid delays and to minimize on-site storage.

1.7 ENVIRONMENTAL REQUIREMENTS

- A. Maintain ambient temperature above 55 degrees Fahrenheit for 5 calendar days before, during, and after installation of solid surfacing fabrications; maintain temperature until Owner's Final Acceptance.

1.8 FIELD MEASUREMENTS

- A. Field dimensions: The fabricator is responsible for details and dimensions not controlled by Project conditions and shall show on his shop drawings all required field measurements beyond his control.
 - 1. The Contractor shall acknowledge the fabricator's need for accurate field dimensions prior to custom fabrication.
 - 2. The Contractor and the fabricator shall cooperate to establish and maintain these field dimensions.

1.9 SEQUENCING AND SCHEDULING

- A. Coordinate the work of this Section with the respective trades responsible for installing interfacing work, and ensure that the work performed hereunder is acceptable to such trades for the installation of their work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
 - 1. Aristec Acrylics LLC (Avonite Surfaces), Florence, KY., product "Avonite".
 - 2. E. I. du Pont de Nemours and Company, Inc., Wilmington DE product, "Corian".

July 11, 2018

3. Formica Corporation, Cincinnati, OH, product: "Solid Surfacing".
4. LG Hausys America, Inc., Adairsville, GA., product "HI Macs"
5. Wilsonart International, Inc. Temple TX, product "Solid Surfaces"

2.2 SOLID SURFACING MATERIALS

- A. Polymer solid surfacing material: Non-porous surfacing material homogeneously composed of natural minerals and high-performance polymer, fabricated sizes and profiles as shown on the Drawings, in colors and finishes as selected by Architect.
 1. Solid surfacing material shall be NSF (National Sanitation Foundation) listed under publication 51 - Plastic Materials and Components used in Food Equipment and bear the "component" mark.
 2. Colors and patterns shall be as selected by the Architect.
- B. Sheet thicknesses shall be as specified below or as otherwise indicated on Drawings.
 1. Countertops: One piece monolithic design 1/2 inch thick with solid plywood backing.
 2. Backsplashes: 1/2-inch thick in locations and heights as shown on the Drawings.

2.3 ACCESSORIES

- A. Plywood backing for countertops: APA C-C PLUGGED EXT, fir plywood, sanded, thickness as indicated on Drawings.
- B. Adhesive for build-up of solid surfacing sheets: color matched two-component seam adhesive as provided by solid surfacing manufacturer.
- C. Adhesive for installation of trim components, neoprene panel adhesive or structural silicone glazing sealant, as recommended by solid surfacing manufacturer.
- D. Sealant, for joints between countertops and dissimilar materials: One component acetoxysilicone rubber, mildew resistant, FS TT-S-001543A, Type Non-Sag, Class A, and FS TT-S-00230C, Type II, Class A and ASTM C 920, Type S, Class 25, Grade NS, use NT, G and A with a minimum movement capability of ± 25 percent, and a Shore A hardness of 20, in manufacturer's standard colors as selected by the Architect, equal to one of the following:
 1. Dow Corning Corporation, Midland MI.; product, "786".
 2. General Electric Company, Waterford NY.; product, "Sanitary 1700".
 3. Sonneborn Building Products Inc., Minneapolis MN.; product, "Sonolastic - OmniPlus".
 4. Tremco, Beachwood OH.; product, "Proglaze".
- E. Bolts, nuts, washers, lags, pins, and screws: Of size and type to suit application chrome finish in exposed-to-view locations.
- F. Concealed supports for edge and corner backing shall be kiln dried birch or poplar.

July 11, 2018

2.4 FABRICATION

- A. Coordinate the fabrication of solid surfacing products with that of the various trades responsible for installing materials and items which will be inserted into, or applied to, the countertop surfaces. Obtain and verify templates, dimensions, and instructions from the respective trades before making cut-outs, holes, slots, and other cutting in the countertops.
- B. Shop fabricate all solid surfacing items in strict accordance with the details on the Drawings, the approved shop drawings, and recommendations of the solid surfacing manufacturer
 - 1. Prepare countertops for undermount design sinks furnished and installed under Division 22 - PLUMBING.
 - 2. Prepare solid surfacing fabrications for installation of plumbing fixtures.
- C. Fit corners and joints hairline. Make all field joints and miters tight, secure with concealed fasteners.
- D. Provide shop fabricated counters, shop mitered components, closure trims with ample allowance for field cutting and fitting. Provide additional trim as required for scribing and site cutting.
- E. Route all edges to be butted for a smooth, clean fit. Sand edges with 120 grit sandpaper to rough up surfaces for adhesive bonding. Clean with denatured alcohol.
- F. Prepare and apply adhesive in compliance with manufacturer's written instructions. Clamp all components using manufacturer's approved clamping methods at all joints and build-up laminations, maintain clamping until adhesive is set. Avoid over-tightening clamps and squeezing out adhesive.
- G. Remove excess adhesive when dry with router. Follow with belt sander using 120 grit, diagonal to joint. After adhesive is leveled and smooth with surface, proceed with final shaping and finishing.
- H. After shaping, smooth finish of cut surfaces equal to manufacturer's original finish. Sand surfaces smooth with wet 400 grit sandpaper. Remove superficial scratches and sander markings, buff with nylon buffing pads as recommended by solid surfacing manufacturer. Wipe surfaces clean and dry with cloths.
- I. Finished work shall be free from visible adhesive and pencil marks.
- J. Field touch-up: Shall be the responsibility of the installer and shall include the filling, and touch-up of exposed job made nail or screw holes, refinishing of surfaces resulting from job fitting, repair of job inflicted scratches and marks, and final cleaning up of the finished surfaces.

PART 3 - EXECUTION

3.1 INSTALLATION - GENERAL

- A. General: Install work in accordance with manufacturer's instructions.
- B. Solid surfacing shall be installed plumb, level, true and straight without distortions:

1. Use concealed shims as required
 2. Work shall be installed to a tolerance of 1/8 inch in 8 feet for plumb and levelness, including tops.
 3. There shall be no variations in flushness of adjoining surfaces.
- C. Tops and trim shall be scribed and trimmed to fit adjoining work.
1. Where cuts occur, refinish surfaces and repair damaged finishes
- D. Secure solid surfacing fabrications to blocking directly attached to substrates.
1. Secure fabrications using concealed fasteners.
 2. Anchor tops securely to base units and to other support systems as required.
- E. After installation and leveling of solid surfacing fabrications has been completed; apply a continuous bead of specified sealant to all joints which abut walls or partitions. Tool the sealant to a uniformly dense surface, level with the edges of the casework. Immediately remove all excess sealant from solid surfacing surfaces.

3.2 TOLERANCES

- A. Maximum variation from true position 1/16 inch with a maximum of 1/32 inch offset from true alignment with adjoining surfaces intended to be flush.

3.3 CLEANING

- A. Daily clean work areas by sweeping and disposing of scraps.
- B. Clean excess sealant by moderate use of mineral spirits or other solvent acceptable to sealant and solid surfacing manufacturers.
- C. Wash down exposed surfaces with a solution of mild detergent in warm water, applied with soft clean wiping cloths. Take care to remove dirt from corners. Wipe surfaces clean.

3.4 PROTECTION

- A. Protect installed fabrications in a manner acceptable to fabricator and installer, which shall ensure no damage or deterioration at the time of Final acceptance of Project by the Architect.

End of Section

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Section 07 00 02
ROOFING AND FLASHING FILED SUB-BID REQUIREMENTS
(FILED SUB-BID REQUIRED)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. The BIDDING REQUIREMENTS, CONTRACT FORMS, and CONTRACT CONDITIONS as listed in the Table of Contents, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Work of this Section requires Filed Sub-bids and is governed by the provisions of the Massachusetts General Laws (MGL), Public Bidding Law - Chapter 149, Sections 44A to 44J inclusive, as amended, and applicable Sections of the MGL, Public Contract Law - Chapter 30.
- C. Specification requirements for the Filed Sub-bid "Roofing and Flashing" include all of the following listed Specification Sections: in their entirety:
 - 1. Section 07 00 02 - Roofing and Flashing Filed Sub-bid Requirements.
 - 2. Section 07 31 13 - Asphalt Shingles.
 - 3. Section 07 62 00 - Sheet Metal Flashing and Trim.
 - 4. Section 08 62 00 - Unit Skylights
- D. The work to be completed by the Filed Subcontractor for the work of this Section is shown on the following listed Drawings, not just those pertaining particularly to this Sub-Trade, unless specifically called out otherwise, regardless of where among the Drawings it appears:
 - G-001 TITLE SHEET
 - G-002 CODE SUMMARY, NOTES & DRAWING LIST
 - AD-101 EXISTING & SELECTIVE REMOVAL PLANS
 - A-102 SECOND FLOOR PLAN
 - A-103 ROOF PLAN
 - A-201 EXTERIOR ELEVATIONS
 - A-202 EXTERIOR ELEVATIONS
 - A-301 BUILDING SECTIONS
 - A-302 WALL SECTIONS
 - A-303 EXTERIOR DETAILS
 - A-404 INTERIOR RAMP
 - A-405 STAIR 2
 - A-406 PORCH RAMP AND STAIR 3
 - A-407 STAIR 4 AND STAIR 5
 - A-408 TYPICAL EXTERIOR STAIR DETAILS
- E. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the Work of this Filed Subcontract.
 - 1. Refer to Section 01 23 00 - ALTERNATES, for Bid alternates which may affect the scope of Work of this Section.

F. Filed Sub-Bids for work under this Section shall be for the complete work and shall be submitted electronically to the Awarding Authority at time, and in manner stipulated in the INVITATION TO BID and INSTRUCTIONS TO BIDDERS.

1. Each Sub-Bid submittal for work under this Section shall be accompanied with the required bid deposit.

G. Sub-Sub Bid Requirements: NONE REQUIRED UNDER THIS SECTION.

1.2 EXAMINATION OF SITE AND DOCUMENTS

A. 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 (Owner) will not be responsible for errors, omissions and/or charges for extra work arising from General Contractor's or Filed Subcontractor's failure to familiarize themselves with the Contract Documents or existing 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.

1.3 MEETINGS AND CONFERENCES

A. Pre-Bid Conference: Filed-Sub-Bidders are strongly encouraged to attend the Pre-Bid Conference; refer to INVITATION TO BID for date and time.

1.4 SEQUENCING

- A. Coordinate work of this Filed-Subcontract with that of other trades, affecting or affected by this work, and cooperate with the other trades as is necessary to assure the steady progress of work.
- B. Do not order or deliver any materials until all submittals, required in the listed Specification Sections included as part of this Filed-Subcontract, have been received and approved by the Architect.
- C. Before proceeding with installation work, inspect all project conditions and all work of other trades to assure that all such conditions and work are suitable to satisfactorily receive the work of this Section and notify the Architect in writing of any which are not. Do not proceed further until corrective work has been completed or waived.

PART 2 - PRODUCTS

2.1 WOOD BLOCKING AND NAILERS FOR ROOFING AND FLASHING

A. Pressure preservative treated solid wood and plywood blocking required for all work of this Filed-Sub-bid 07 00 02 is specified under Section 06 10 00 – ROUGH CARPENTRY.

July 11, 2018

2.2 SCAFFOLDS AND STAGING

- A. General: Filed Subcontractors shall obtain required permits for, and provide scaffolds, staging, and other similar raised platforms, required to access their Work as specified in Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS and herein.
 - 1. Scaffolding and staging required for use by this Filed Subcontractor pursuant to requirements of Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS shall be furnished, erected, maintained in a safe condition, and dismantled when no longer required, by this Filed Sub-trade requiring such scaffolding.
 - 2. Each Filed Subcontractor is responsible to provide, maintain and remove at dismantling, all tarpaulins and similar protective measures necessary to cover scaffolding for inclement weather conditions other than those required to be provided, maintained and removed by the General Contractor pursuant to MGL (Refer to Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS and as additionally required for dust control).
 - 3. Furnishing portable ladders and mobile platforms of all required heights, which may be necessary to perform the work of this trade, are the responsibility of this Filed Subcontractor.

2.3 HOISTING MACHINERY AND EQUIPMENT

- A. All hoisting equipment, rigging equipment, crane services and lift machinery required for the work by this Filed-Sub Contractor shall be furnished, installed, operated and maintained in safe conditions by this Filed-Sub Contractor, as referenced under Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS.

PART 3 - EXECUTION

3.1 SITE MAINTENANCE

- A. The Roofing and Flashing Filed Subcontractor shall furnish and maintain dumpsters as required to adequately control the disposal of all trash, construction debris, and waste materials resulting from the work of this Filed Sub-Trade.
 - 1. The Roofing and Flashing Filed Subcontractor is responsible for all costs to obtain, maintain and disposal of dumpsters.
 - 2. Disposal: Empty dumpsters on frequent regular basis as necessary to prevent overflow spillage. Legally dispose of waste off-site.
- B. Daily clean work areas. Sweep and place into the dumpster(s) furnished by this trade, all removed existing roofing and flashing materials, pallets, construction debris, unused materials, and other waste materials resulting from the Work of this Filed-sub-trade.
- C. After completion of the work of this Section, remove equipment, tools, and unused materials, remove all remaining waste materials and construction debris related to the work of this Filed Sub-trade. Clean all exterior finish materials completely free from adhesives, sealants, and other materials installed under this Section.

End of Section

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Section 07 11 13
BITUMINOUS DAMPPROOFING

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. The BIDDING REQUIREMENTS, CONTRACT FORMS, and CONTRACT CONDITIONS as listed in the Table of Contents, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. Furnish and install fluid applied bituminous dampproofing:
 - 1. Apply over exterior of building foundation walls, below grade.

1.3 RELATED REQUIREMENTS

- A. Section 03 30 00 - CAST-IN-PLACE CONCRETE.

1.4 REFERENCES

- A. Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES.
 - 1. ASTM D1227 - Emulsified Asphalt Used as a Protective Coating for Roofing.
 - 2. ASTM D2823 - Asphalt Roof Coatings.
 - 3. ASTM D449 - Asphalt Used in Dampproofing and Waterproofing.
 - 4. ASTM D4586 - Asphalt Roof Cement, Asbestos-Free.
 - 5. NRCA Roofing and Waterproofing Manual.

1.5 SUBMITTALS

- A. Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
 - 1. Literature: Manufacturer's product data sheets, specifications, performance data, physical properties for dampproofing.
 - 2. Manufacturer's application instructions including, joint and crack treatment, application temperature range, and any special procedures.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Deliver and store dampproofing materials in new, sealed, containers showing manufacturer's identification, year of production, net weight, date of packaging, and location of packaging.

July 11, 2018

- B. Store all materials following manufacturer's recommended storage procedures for humidity and temperature conditions, protect materials from freezing and from high heat, flames or sparks.

1.7 ENVIRONMENTAL CONDITIONS

- A. Do not apply when ambient temperatures may fall below 35 degrees Fahrenheit for 24 hours before and during application and until membrane has cured.

1.8 SEQUENCING AND SCHEDULING

- A. Coordinate and schedule the work of this Section with the related work of Section 04 20 00 - UNIT MASONRY, in a manner so as not to delay the smooth progress of the Work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or equal:
 1. Karnak Corporation, Clark NJ.
 2. Tremco Barrier Solutions, Inc., Reynoldsburg OH
 3. W.R. Meadows, Inc., Hampshire IL.

2.2 MATERIALS

- A. Dampproofing at below grade foundation walls: Solvent based, non-asbestos, bituminous compound equal to Karnak Product: "Number 229AR Elastomeric" complying with ASTM C836.
 1. Protection board: 1.0 pound per cubic foot density, 1 inch thick expanded polystyrene protection board.
- B. Crack filler: As recommended by the dampproofing manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Inspect all surfaces and verify that they are in proper condition to receive the work of this Section.
 1. Verify items which penetrate surfaces to receive dampproofing are rigidly installed.
 2. Verify surfaces are free of cracks, depressions, waves, or projections which may be detrimental to successful installation.
- B. Notify the Contractor if substrate requires patching of holes over 1/2 inch in diameter or length and over 1/4 inch deep, by Section 04 20 00 - UNIT MASONRY. Do not proceed until patching is completed.

July 11, 2018

- C. Do not apply dampproofing to damp, frozen, dirty, dusty or surfaces unacceptable to dampproofing manufacturer.
- D. Beginning of installation means acceptance of existing substrate and site conditions.

3.2 PREPARATION

- A. Perform all preparation work on receiving surfaces as required, including removal of fins, scaling, and projecting rough spots, and removal of all loose mortar, dirt, oil, and other foreign matter from the substrate.
- B. Protect adjacent surfaces not designated to receive dampproofing.
- C. Cracks and joints in substrate surface must be properly sealed as recommended by the dampproofing manufacturer.

3.3 APPLICATION

- A. Perform the application of the dampproofing in strict accordance with the manufacturer's installation instructions, and as specified herein.
 - 1. Apply joint tape at all sheathing joints . Apply thin coating of dampproofing material over joints and embed joint tape.
- B. Apply primer when so required by manufacturer's instructions.
- C. Trowel, spray or brush apply as applicable to specified product, in one coat leaving no pinholes, defects or undercoated areas. Apply at coverage rate recommended by the manufacturer but not less than 4 to 6 gallons per 100 square feet.
- D. After application of dampproofing is completed, carefully inspect the entire dampproofed surface for defects therein and patch all defects discovered.

3.4 PROTECTION

- A. Protect dampproofing film and allow to cure for at least 48 hours before installation of rigid insulation.

End of Section

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Section 07 21 00
THERMAL INSULATION

PART 1 – GENERAL

1.1 GENERAL PROVISIONS

- A. The CONTRACT FORMS, and CONTRACT CONDITIONS as listed in the Table of Contents, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. The work of this Section consists of building insulation where shown on the Drawings, as specified herein, and as required for a complete and proper installation. Work includes, but is not limited to the following scope.
- B. Furnish and install the following:
 - 1. Rigid insulation beneath interior concrete slabs.
 - 2. Rigid insulation at perimeter foundation walls.
 - 3. Foil-faced thermal batt insulation between roof framing with insulation baffles.
 - 4. Kraft-faced thermal batt insulation between wall framing.
 - 5. Low pressure, low expansion polyurethane foamed-in-place insulation / air barrier sealant: applied to seal gaps, cracks, cavities and joints in the building envelope, at door frames, perimeter of window frames, and other similar penetrations in exterior walls.
 - 6. Sill sealer.
 - 7. Accessories related to the installation of insulation.

1.3 RELATED REQUIREMENTS

- A. Section 02 41 19 - SELECTIVE DEMOLITION: Removal of existing partitions, walls and related insulation.
- B. Section 06 10 00 - ROUGH CARPENTRY: Wood blocking, nailers.
- C. Section 06 20 00 - FINISH CARPENTRY: Acoustical batt insulation behind acoustical wood panels.
- D. Section 07 26 00 - VAPOR RETARDERS:
 - 1. Vapor barrier, seam tape, pipe boots, detail strip for installation under concrete slabs.
- E. Section 09 81 00 - ACOUSTICAL INSULATION: Acoustical batt insulation between framing members.
- F. Section 09 29 00 - GYPSUM BOARD: Installation of wall board over insulation in Z-channel furring system.

July 11, 2018

- G. Division 23 - HEATING, VENTILATING AND AIR CONDITIONING: Ductwork and piping insulation.

1.4 REFERENCES

- A. Referenced Standards: Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. The standards referenced herein are included to establish recognized minimum quality only. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern. Equivalent quality and testing standards will be acceptable, subject to their timely submission, review and acceptance by the Architect.
 1. ASTM C 203 - Breaking Load and Flexural Properties of Block Type Thermal Insulation.
 2. ASTM C 518 - Thermal Transmission Properties by Means of the Heat Flow Meter.
 3. ASTM C 578 - Preformed Cellular Polystyrene Thermal Insulation.
 4. ASTM D 1621 - Compressive Properties of Rigid Cellular Plastics.
 5. ASTM E 136 - Behavior of Materials in a Vertical Tube Furnace at 750°C.
 6. ASTM E 84 - Surface Burning Characteristics of Building Materials.
 7. ASTM E 96 - Water Vapor Transmission of Materials.
 8. All applicable federal, state and municipal codes, laws and regulations for thermal insulation.
- B. Definitions:
 1. The term "R-Value" referred to herein refers to the thermal resistance of the insulation alone and does not allow consideration of air spaces or other factors.

1.5 SUBMITTALS

- A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
 1. Product Data: Manufacturer's product data sheets, specifications, performance data, physical properties for each item furnished hereunder.

1.6 QUALITY ASSURANCE

- A. General: Notify the Architect where conflicts apply between referenced standards and existing materials, and existing methods of construction.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Delivery and Acceptance Requirements:
 1. Do not deliver items to the site, until all specified submittals have been submitted to, and approved by, the Architect.
 2. Deliver materials in original packages, containers or bundles bearing brand name and identification of manufacturer or supplier.
- B. Storage and Handling Requirements:

1. Store and handle materials following manufacturer's recommended procedures, and in accordance with material safety data sheets.
 - a. Rigid board insulation materials are combustible and may constitute a fire hazard, do not expose insulation materials to open flames or other ignition sources, comply fully with manufacturer's recommendations and the requirements of local authorities having jurisdiction, for delivery, handling, storage and installation.
 2. Protect materials from damage due to moisture, direct sunlight, excessive temperatures, surface contamination, corrosion and damage from construction operations and other causes.
- C. Damaged material: Remove any damaged or contaminated materials from job site immediately, including materials in packages containing water marks, or show evidence of mold.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
1. Rigid insulation board (extruded polystyrene):
 - a. Dow Chemical Corp., Midland MI.
 - b. Owens Corning Commercial Insulation, Toledo OH.
 - c. Kingspan Insulation LLC; Atlanta, GA.
 - d. DiversiFoam Products, Rockford, MN
 2. Glass fiber batt/blanket insulation:
 - a. CertainTeed Corporation, Valley Forge PA.
 - b. Johns Manville Building Insulation, Denver CO
 - c. Owens Corning Fiberglas Corp., Toledo OH.
 - d. (Goldline brand) Schuller International, Inc., Denver CO.
 - e. USG Corp./ USG Interiors Inc., Chicago IL.
 3. Low pressure polyurethane foamed-in-place insulation / air barrier sealant:
 - a. Fomo Products, Inc., Norton OH.
 - b. Dow Chemical Company, Midland, MI.
 - c. Premier industrial Supply, Phoenix AZ.
 - d. Convenience Products, Division of Clayton Corp., Fenton MO.
 - e. Henry Company, El Segundo, CA.
- B. Acceptable Substitutions: To establish a minimum standard of quality, design and function desired, the Schedule at the end of this Section indicates a single manufacturer of each product, other manufacturers will be considered for acceptance per the following:

1. Contractor must provide appropriate product data with bid for the Architect to consider the substitutions as "equal" to the manufacturer and product specified.
2. Contractor must include unit prices showing any add or deduct costs for all recommended substitutions which have a greater or lesser cost than furnishing and installing the specified manufacturer and product.

2.2 MATERIALS

- A. Under-slab and foundation insulation, rigid extruded polystyrene insulation: Closed cell foam board, square edge, conforming to ASTM C 578, Type IV, with a compressive strength of 25 pounds per square inch when tested in accordance with ASTM D 1621.
1. Panel size: 48 by 96 inches beneath slab, and 24 by 96 inches at verticals.
 2. Minimum R-value: 5 per inch thickness.
 3. Thickness: 3 inches.
 4. Acceptable products include but are not limited to:
 - a. Dow Chemical Corp., product, Styrofoam Brand "Square Edge"
 - b. Owens Corning, product "Foamular 250".
 - c. Kingspan Insulation LLC, product "GreenGuard Type IV 25 PSI Insulation Board".
 - d. DiversiFoam Products, product "CertiFoam 25 SE".
- B. Thermal batt/blanket glass fiber insulation conforming to ASTM C-665 Type I, un-faced, comprised of inorganic fibers bonded with formaldehyde-free thermosetting resin.
1. Surface burning characteristics when tested per ASTM E84:
 - a. Flame Spread: 25 or less.
 - b. Smoke Developed: 50 or less.
 2. Thicknesses and R-values:
 - a. Walls: Nominal 5-1/2 inch thick having R-21 thermal rating.
 - b. Roof/Ceiling Construction: Nominal 12 inches thick having R-38 thermal rating.
 3. Width: Provide width appropriate for spacing of framing or furring members with which used.
 4. Recycled content of glass in glass-fiber insulation: Use maximum available percentage of recycled glass. Fiber glass insulation products incorporated into the work shall contain not less than 20 percent of recycled glass cullet.
- C. Foamed-in-place insulation for air barrier sealant: Low pressure polyurethane foam sealant. Acceptable products include the following or approved equal:
1. Fomo Products, Inc., product: "Handi Foam" or "Handi-Seal".
 2. Dow Chemical Company, product: "Great Stuff Pro".
 3. Premier industrial Supply, product: "XtraFoam".
 4. Convenience Products, Division of Clayton Corp., product: "Touch 'n Foam No Warp".

5. Henry Company, product: "NailTite NT-100".

2.3 ACCESSORIES

- A. Staples, tape, adhesives and fasteners required for the proper and complete installation for work of this Section shall be as recommended by each respective manufacturers of each insulation type.
- B. Insulation baffles: Expanded polystyrene insulation baffles, sized for width of framing. equal to:
 1. Foam Plastics of New England., Prospect, CT. product "Dura-Foam Rafter Vent".
 2. Poly Foam Inc., Prairie, MN. product "Propervent".
- C. Sill sealer: Compressible polystyrene strip, minimum ¼ inch thick by width of framing. Acceptable products include the following, or approved equal.
 1. Amoco Foam, Products Company, Atlanta GA. Product "Amofoam Sill Sealer".
 2. Dow Chemical Corp., Midland MI., product "Styrofoam Sill Seal"
 3. Pactiv Building Products, Lake Forest IL. product "GreenGuard Sill Sealer"

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verification of Conditions: Inspect all surfaces and verify that they are in proper condition to receive the work of this Section.
 1. Beginning of installation means acceptance of existing substrate and project conditions.

3.2 INSTALLATION

- A. Rigid insulation beneath slabs-on-grade and interior side of foundation walls: 3 inches thick rigid insulation.
 1. Place insulation boards at the perimeter of foundation walls and beneath slabs-on grade.
 - a. Beneath slabs-on-grade, extend insulation to provide 100 percent coverage beneath slab.
 - b. Perimeter foundation walls: provide insulation on interior side of foundation walls extended down at least 24 inches from floor slab.
 2. Butt edges and ends tight to adjacent boards. Bevel insulation to allow snug fit at cants.
 3. Place soil as a perimeter restraint to minimize movement of insulation.
- B. Install insulation baffles between roofing framing members scheduled to receive batt/blanket insulation. Install as recommended by baffle manufacturer in manner to provide continuous free flow of air underside of roof sheathing, from bottom of roof to top of roof.
- C. Batt and blanket insulation between framing members:

1. Install in accordance with manufacturer's instructions. Do not compress or "stuff" insulation into voids, compressed insulation has less thermal resistant value.
 2. Trim insulation neatly to fit spaces. Fit insulation tight in spaces and tight to exterior side of mechanical and electrical services within the plane of insulation, do not cut around electrical boxes. Leave no gaps or voids.
 3. Where faced insulation is specified, apply membrane facing on warm side of building spaces. Lap ends and staple side flanges of membrane between framing members.
 4. Where insulation is located between joists/rafters and is not to be covered, install wire insulation supports to keep insulation in place.
- D. Foamed-in-place insulation / air barrier sealant: Apply insulation in method to a uniform monolithic density without voids, in accordance with manufacturer's instructions.
1. Apply application of foam for air barrier seal includes, but is not limited to:
 - a. Door frames, window frames, and similar penetrations in exterior walls.
 - b. Gaps, cracks, cavities and joints in the building envelope, not sealed with other forms of air boots, including electrical boxes and conduit, ducts, fans, and piping.
 - c. Where additionally indicated on Drawings.
- E. Sill sealer: Install as recommended by manufacturer beneath sills with corrugated side facing down and ends butted.

3.3 CLEANING

- A. Clean work under provisions of Section 01 73 00 – EXECUTION.
- B. Daily clean work areas by sweeping and disposing of debris, and scraps.
- C. Upon completion of the work of this Section in any given area, remove tools, equipment and all rubbish and debris from the work area; leave area in broom-clean condition.

End of Section

Section 07 21 31
CLOSED CELL SPRAYED FOAM INSULATION

PART 1 – GENERAL

1.1 SUMMARY

- A. Furnish and install the following:
 - 1. Closed cell spray polyurethane foamed-in-place insulation.

1.2 RELATED REQUIREMENTS

- A. Section 03 30 00 - CAST-IN-PLACE CONCRETE: Concrete walls.
- B. Section 04 22 00 – CONCRETE UNIT MASONRY: Masonry cavity walls.
- C. Section 07 21 00 - THERMAL INSULATION.
- D. Section 07 92 00 - JOINT SEALANTS: Requirements for joint sealant and backing materials.
- E. Division 23 - HEATING, VENTILATING AND AIR CONDITIONING: Ductwork and piping insulation.

1.3 REFERENCES

- A. Referenced Standards: Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
 - 1. ASTM C 177 - Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus.
 - 2. ASTM C 518 Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter.
 - 3. ASTM C 1029 - Spray Applied Rigid Cellular Polyurethane Thermal Insulation.
 - 4. ASTM D 1621 – Test Method for Compressive Properties of Rigid Cellular Plastics.
 - 5. ASTM D 1622 – Test Method for Apparent Density of Rigid Cellular Plastics.
 - 6. ASTM D 1623 – Test Method for Tensile and Tensile Adhesion Properties of Rigid Cellular Plastics.
 - 7. ASTM D 2126 – Test Method for Response of Rigid Cellular Plastics to Thermal and Humid Aging.
 - 8. ASTM D 2842 – Test Method for Water Absorption of Rigid Cellular Plastics.
 - 9. ASTM D 2856 – Test Method for Open Cell Content of rigid Cellular Plastics by Air Pycnometer.
 - 10. ASTM E 136 - Behavior of Materials in a Vertical Tube Furnace at 750°C.
 - 11. ASTM D 5116 - Small-Scale Environmental Chamber Determinations of Organic Emissions From Indoor Materials/Products.
 - 12. ASTM E 84 - Surface Burning Characteristics of Building Materials.

July 11, 2018

13. ASTM E 96 - Water Vapor Transmission of Materials.
14. ASTM E 2176 – Air Barrier Materials.
15. UL - Building Products Directory.
16. CAN/ULC-S705.1-01 Standard for Thermal Insulation - Medium Density Closed Cell Spray Applied Rigid Polyurethane Foam – Material Specification.
17. CAN/ULC-S705.2-05 Standard for Thermal Insulation - Medium Density Closed Cell Spray Applied Rigid Polyurethane Foam – Application.
18. All applicable federal, state and municipal codes, laws and regulations for thermal insulation and vapor barriers.

B. Definitions:

1. The term “AVB” referenced herein refers to “Air and Vapor Barrier” system.
2. The term “ccSPF” referenced herein refers to “Closed Cell Spray Polyurethane Foam” insulation.
3. The "R-Value" referred to herein refers to the thermal resistance of the insulation alone and does not allow consideration of air spaces or other factors.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. General: Coordinate the work of this Section with the respective trades responsible for installing interfacing and adjoining work for proper sequence of installation, and ensure that the work performed hereunder is acceptable to such trades for the installation of their work.

1.5 SUBMITTALS

A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:

1. Product Data: Provide data on material characteristics, performance criteria, and limitations.
 - a. Submit letter from primary materials manufacturer indicating approval of products not manufactured by primary manufacturer.
 - b. Include statement that materials are compatible with adjacent materials proposed for use.
2. Manufacturer's certifications:
 - a. Provide an Evaluation Report as the manufacturer's documentation confirming material has been evaluated and conforms to the requirements of the ASTM E2176 Standard for Air Barrier Materials.
 - b. Certification from an independent testing laboratory that insulation meets fire hazard classification requirements.
3. Shop Drawings: Developed for specific project conditions including mock-up, submittal of manufacturer's standard details are prohibited.
4. Manufacturers installation instructions: indicate preparation, installation requirements and techniques, product storage and handling criteria, and limitations of the material.

- B. Closeout Submittals: Submit the following under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS.
 - 1. Bonds and Warranty Documentation:
 - a. Manufacturer's Warranties and Guarantees as specified elsewhere herein this Section.

1.6 QUALITY ASSURANCE

- A. General: Notify the Architect where conflicts apply between referenced standards and existing materials, and existing methods of construction.
- B. Sole Source: Obtain products required for the Work of this Section from a single manufacturer, or from manufacturers recommended by the prime manufacturer of sprayed foam insulation.
- C. Qualifications:
 - 1. Installer/Applicator: Minimum of 3 years documented experience demonstrating previously successful work of the type specified herein, and a licensed applicator by product manufacturer.
 - a. Provide proof of manufacturer's certification upon request.
- D. Certifications:
 - 1. Fire Hazard Classification: Maximum flame spread/smoke developed rating of 25/450, tested to ASTM E84.
- E. Manufacturer's Installation Review: Make arrangements to have Manufacturer's representative (employed by manufacturer) on-site during work of this Section to periodically review installation procedures. A minimum of 2 site visits are required.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Delivery and Acceptance Requirements:
 - 1. Do not deliver items to the site, until all specified submittals have been submitted to, and approved by, the Architect.
 - 2. Deliver materials in original unopened packages, containers or bundles bearing brand name, and identification of manufacturer, with labels and package seals intact and legible.
- B. Storage and Handling Requirements:
 - 1. Store and handle materials following manufacturer's recommended procedures, and in accordance with material safety data sheets.
 - 2. Protect materials from damage due to moisture, direct sunlight, excessive temperatures, surface contamination, corrosion and damage from construction operations and other causes.
- C. Damaged material: Remove any damaged or contaminated materials from job site immediately, including materials in broken packages, packages containing water marks, or show other evidence of damage, unless Architect specifically authorizes correction thereof and usage on project.

July 11, 2018

1.8 SITE CONDITIONS

- A. Maintain temperature and humidity recommended by the materials manufacturer for 24 hours before, during, and 48 hours after installation of sprayed foam insulation.
- B. Field Conditions: Do not install spray foam insulation in snow, rain, fog, or mist. Do not install air barrier when the temperature of substrate surfaces and surrounding air temperatures are below those recommended by the manufacturer.

1.9 WARRANTY

- A. General: Submit warranties under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS.
- B. Special Warranty:
 - 1. Warrant work of this section against defects or deficiencies for a period of two years from the date work is certified as substantially performed in accordance with general condition of the contract.
 - 2. Promptly correct, at own expense, defects or deficiencies which become apparent within the warranty period.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following:
 - 1. Bayer Material Science Bay Systems, Phoenix, AZ, product "Bayseal CC".
 - 2. Resin Technology/Henry Company, Inc., Huntington Park, CA, product "Permax Spray System RT 2045 Series".
 - 3. BASF Polyurethane Foam Enterprises, LLC, Minneapolis, MN, product "WALLTITE".
 - 4. Demilec (USA) LLC, Arlington, TX., product "Heatlok Soy 200".
 - 5. Johns Manville Insulation Systems, Denver CO., product "Corbond III".
 - 6. NCFI Polyurethanes, Inc., Mount Airy, NC., product "InsulStar" spray foam insulation.

2.2 DESCRIPTION

- A. General Description: Plastic resin and catalyst, cold setting low-density, closed-cell foam, two component system.

2.3 PERFORMANCE/DESIGN CRITERIA

- A. General:
 - 1. Air permeability: Not to exceed 0.004 cubic feet per minute per square foot under a pressure differential of 0.3 in. water (1.57 psf) (0.02 L/sm @ 75 Pa.) when tested according to ASTM E 2178.

2. All penetrations of the sprayed foam insulation, and paths of air infiltration/exfiltration shall be made airtight.
- B. VOC Regulations: Provide products which comply with applicable regulations controlling the use of volatile organic compounds.
- C. Outgassing/Reactivity or Toxicity/Hazardous Materials:
1. Formaldehyde: Products containing urea-formaldehyde will not be permitted.
 2. Chlorofluorocarbons (CFCs)/HCFCs: Products and equipment requiring or using CFCs or HCFCs during the manufacturing process will not be permitted.
- D. Performance criteria: Material shall meet requirements of ULC S705.1, Standard for Thermal Insulation - Spray Applied Rigid Polyurethane Foam, Medium Density - Material - Specification. CCMC Evaluation Report or reports from accredited testing laboratory shall be made available upon request.
1. Long Term Thermal Resistance (LTTR): 6.4 per inch, when tested in accordance with ASTM C518.
 2. Closed cell content: 90 percent minimum when tested in accordance with ASTM D 1940, ASTM D 2856 or ASTM D 6226
 3. Density: Minimum 1.9 pounds per cubic foot minimum when tested in accordance with ASTM D 1622.
 4. Compressive Strength: 15 pounds per square inch minimum when tested in accordance with ASTM D 1621.
 5. Tensile Strength: 28 pounds per square inch minimum when tested in accordance with ASTM D 1623.
 6. Dimensional Stability: 11 percent change in volume maximum at 158 degrees F and 95 percent relative humidity when tested in accordance with ASTM D 2126.
 7. Water Absorption: 0.025 (grams per cubic centimeter) when tested in accordance with ASTM D 2842.
 8. Air Leakage (for 4 inches of material): ASTM E 283-04; 0.01 L/s/m² @ Pa maximum.
 9. Sound Transmission Class (STC): ASTM E 90-04; STC 43 minimum.
 10. Noise Reduction Coefficient (NRC): ASTM E 90-04; NRC 0.2 minimum.
 11. Bacterial or Fungal Growth: Zero rating when tested in accordance with ASTM G 21.
 12. Flame Spread and Smoke Developed Rating: Flame Spread <25, Smoke Developed <450 when tested in accordance with ASTM E 84-05.
 13. Fuel Contribution: 0 when tested in accordance with ASTM E 84-05.

2.4 EQUIPMENT

- A. Equipment for spraying foam shall be manufactured specifically for the application of polyurethane foam. The equipment shall be airless, capable of maintaining a 1:1 volume ratio and have primary and hose heaters (300 feet of material hose maximum allowable to meet mix pressure requirements.) Acceptable application guns shall include but are not limited to Gusmer GX-7, D Gun, GAP Pro, Fusion,

July 11, 2018

Probler and other direct impingement type mixing guns with low output tips in the 15 pound per minute range or as recommended by the manufacturer.

- B. Equipment settings are to be recorded on the Daily Work Record

2.5 ACCESSORIES

- A. Prime substrate when required by spray polyurethane manufacturer or the membrane manufacturer. The type of primer and the installation of the primer shall follow the requirements of the manufacturer for the surface conditions.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verification of Conditions: Inspect all surfaces and verify that they are in proper condition to receive the work of this Section.
 - 1. Report in writing defects in substrates which may adversely affect the performance of the foam insulation.
 - 2. Beginning of installation means acceptance of existing substrate and project conditions.
- B. Evaluation and Assessment: Examine joints before sealing to ensure configurations, surfaces and widths are suitable for foam sealant.

3.2 PREPARATION

- A. Surface Preparation: Surfaces to receive foam insulation shall be free of frost and loose or foreign matter which might impair adhesion of materials.
 - 1. Prepare surface by brushing, scrubbing, scraping, or grinding to remove loose mortar, dust, oil, grease, oxidation, mill scale and other contaminants which will affect adhesion and integrity of the foam insulation system. Wipe down metal surfaces to remove release agents or other no compatible coatings, using clean sponges or rags soaked in a solvent compatible with the foam insulation. Ensure surfaces are dry before proceeding.

3.3 APPLICATION – SPRAY FOAM

- A. Apply foam insulation in strict accordance with ULC S705.2, manufacturer's written instructions, and the following.
 - 1. Apply foam insulation only when surfaces and ambient temperature are within limits prescribed by the material manufacturer.
- B. Fill joints with foam sealant making allowances for post expansion of foam.
- C. Finish joints shall be free from air pockets and imbedded foreign materials. Cut back excess foam sealant after cutting flush with surrounding surfaces unless otherwise directed and/or detailed.
- D. Apply foam insulation to within the following tolerances: minus 1/4 inch thickness or plus 1/2 inch thickness indicated on the Drawings.
 - 1. Trim, as required, any excess thickness that would interfere with the application of cladding/covering system by other trades.

July 11, 2018

- E. Finished sprayed foam insulation shall be free of voids and imbedded foreign materials.
- F. Do not install spray polyurethane foam within 3 inches of heat emitting devices such as light fixtures and chimneys.
- G. Complete connections to other components and repair any gaps, holes or other damage using material which conforms to ULC S710.1 or ULC S711.1 and installed in accordance with ULC S710.2 or ULC S711.2 as applicable.
- H. Do not allow foam insulation to cover or mark adjacent surfaces. Use masking materials if necessary.
- I. Do not permit adjacent work to damage work of this section. Damage to work of this section caused by other sections shall be made good by this section at the expense of the section which caused the damage.

3.4 INTERFACE WITH OTHER WORK

- A. Coordinate the work of this Section installation of windows and door frames. Ensure air and vapor barrier transitions from windows and door frames is completed.

3.5 FIELD QUALITY CONTROL

- A. Field inspection will be performed under the provisions of Section 01 45 29 - TESTING LABORATORY SERVICES.
- B. Non-Conforming Work: Remove and replace all non-conforming work.

3.6 CLEANING

- A. After completion of the work of this Section, remove equipment, and clean all wall, partition, and floor areas free from deposits of sprayed-foam and other materials installed under this Section.
- B. Clean work under provisions of Section 01 70 00 – EXECUTION.
 - 1. Remove over-spray and masking materials immediately after foam has cured to hard surface film.
 - 2. Clean and make good surfaces soiled or damaged by work of this section. Consult with section of work soiled before cleaning to ensure methods used will not damage the work.

3.7 PROTECTION

- A. Protect finished work under provisions of Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS.
- B. Protect spray foam insulation from ultraviolet light following installation on exterior surfaces, do not leave exposed to weather elements for a period greater than 30 calendar days.

End of Section

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Section 07 26 00
VAPOR RETARDERS

PART 1 – GENERAL

1.1 GENERAL PROVISIONS

- A. The BIDDING REQUIREMENTS, CONTRACT FORMS, and CONTRACT CONDITIONS as listed in the Table of Contents, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. Furnish and install the following:
 - 1. Vapor barriers and in walls, floor assemblies and roof assemblies.
 - 2. Sheet membrane vapor barriers (vapor retarders) under concrete slabs-on-grade including seam tape, and pipe boots.

1.3 RELATED REQUIREMENTS

- A. Section 03 30 00 - CAST-IN-PLACE CONCRETE: Concrete slabs on grade.
- B. Section 06 10 00 - ROUGH CARPENTRY: Wood framing, blocking, nailers.
- C. Section 07 11 13 - BITUMINOUS DAMPPROOFING: Dampproofing at foundation walls.
- D. Section 07 21 00 - THERMAL INSULATION: Thermal insulation.

1.4 REFERENCES

- A. Reference Standards: Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
 - 1. ASTM D 570 - Water Absorption of Plastics.
 - 2. ASTM D 1004 - Initial Tear Resistance of Plastic Film and Sheeting.
 - 3. ASTM D 1622 - Apparent Density of Rigid Cellular Plastics.
 - 4. ASTM D 1938 - Tear Propagation Resistance of Plastic Film and Thin Sheeting by a Single-Tear Method.
 - 5. ASTM D 2842 - Water Absorption of Rigid Cellular Plastics.
 - 6. ASTM D 2582 - Puncture-Propagation Tear Resistance of Plastic Film and Thin Sheeting.
 - 7. ASTM D 2856 - Open Cell Content of rigid Cellular Plastics by Air Pycnometer.
 - 8. ASTM E 136 - Behavior of Materials in a Vertical Tube Furnace at 750°C.

9. ASTM E 154 - Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover
10. ASTM E 1643 - Standard Practice for Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs.
11. ASTM E 1745 - Plastic Vapor Retarders Used in Contact with Soil or Granular fill under Concrete Slabs
12. ASTM E 84 - Surface Burning Characteristics of Building Materials.
13. ASTM E 96 - Water Vapor Transmission of Materials.

B. General References The following reference materials are hereby made a part of this Section by reference thereto:

1. ACI 302.1R Vapor Barrier Component (plastic membrane) is not less than 10 mils thick.
2. NFPA 701 - Fire Tests for Flame Resistant Textiles and Films
3. All applicable federal, state and municipal codes, laws and regulations for thermal insulation and vapor barriers.

1.5 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. General: Coordinate the work of this Section with the respective trades responsible for installing interfacing and adjoining work for proper sequence of installation, and ensure that the work performed hereunder is acceptable to such trades for the installation of their work.

B. Sequencing: Coordinate work of this section with related work.

1.6 SUBMITTALS

A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:

1. Product Data: Manufacturer's product data sheets, specifications, performance data, physical properties for each item furnished hereunder.
2. Manufacturer's Instructions: Manufacturer's installation instructions for placement, seaming and pipe boot installation.

1.7 QUALITY ASSURANCE

A. General: Notify the Architect where conflicts apply between referenced standards and existing materials, and existing methods of construction.

B. Sole Source: Obtain products required for the Work of this Section for each type of vapor retarder shall be from a single manufacturer, and the related accessories as recommended by the prime manufacturer of the vapor retarder.

1.8 DELIVERY, STORAGE AND HANDLING

A. Delivery and Acceptance Requirements:

1. Do not deliver items to the site, until all specified submittals have been submitted to, and approved by, the Architect.
 2. Deliver materials in original packages, containers or bundles bearing brand name and identification of manufacturer or supplier.
- B. Storage and Handling Requirements:
1. Store and handle materials following manufacturer's recommended procedures, and in accordance with material safety data sheets.
 2. Store materials under cover and in manner to keep them dry, protected from weather, direct sunlight and damage from construction traffic and other causes.

PART 2 - PRODUCTS

2.1 VAPOR BARRIERS WITHIN BUILDING ASSEMBLIES

- A. Sheet plastic vapor barrier: Clear polyethylene film, 0.006 inches (6 mil) thick provided in full-wall length and width pieces, without joints, wherever possible.

2.2 UNDER SLAB VAPOR BARRIERS

- A. Manufacturers and products:
1. Specified Product (Basis of Design): To establish a standard of quality, design and function desired, Drawings and specifications have been based on Stego Industries LLC company, Product: "Stego Wrap (15 mil)".
 2. Acceptable manufacturers: Subject to compliance with the requirements specified herein, products which may be incorporated in the work include, but are not limited to, the following:
 - a. Stego Industries LLC, San Juan Capistrano, CA, product: "Stego Wrap (15 mil)".
 - b. W.R. Meadows, Hampshire, IL, product: "No. 723 Perminator (15 mil)".
 - c. Reef Industries, Houston, TX, product "Griffolyn -15 Mil Green".
 - d. Insulation Solutions Inc., East Peoria IL, product "Viper II, 15 mil vapor barrier".
- B. Characteristics:
1. Minimum thickness: 15 mils.
 2. Permeance complying with ACI 302.2R.
 3. Permeance after conditioning when tested in accordance with ASTM E 1745 (where applicable): Less than 0.01 perms ($gr/ft^2/hr/in-Hg$).
 4. Water vapor barrier tested by ASTM E-1745: Meets or exceeds Class A.

2.3 ACCESSORIES

- A. General: Staples, tape, adhesives and fasteners required for the proper and complete installation for work of this Section shall be as recommended by each respective manufacturers of each type of vapor barrier.

July 11, 2018

- B. Air seal boot: PVC or EDPM premolded pipe and seal for penetrations at ceiling vapor barrier.
- C. Pipe Boots: Construct pipe boots from vapor barrier material and pressure sensitive tape per manufacturer's instructions.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Ensure that subsoil is approved by Architect.
- B. Level and tamp or roll aggregate, sand or tamped earth base.

3.2 INSTALLATION - VAPOR BARRIERS WITHIN BUILDING ASSEMBLIES

- A. Place vapor and air barrier on warm side of all insulation by stapling at 6 inches on center. Lap and seal all sheet joints.
- B. Extend vapor and air barrier tight to full perimeter of adjacent window and door frames and other items interrupting the plane of membrane. Tape seal in place.

3.3 INSTALLATION - BELOW-SLAB VAPOR BARRIERS/RETARDERS

- A. General: Install Vapor Barrier in accordance with manufacturer's instructions and ASTM E 1643. Place vapor barrier beneath all floor slabs
- B. Unroll Vapor Barrier with the longest dimension parallel with the direction of the pour.
- C. Lap Vapor Barrier over footings and seal to foundation walls.
- D. Overlap joints a minimum of six inches with top lap in direction of spreading concrete. Turn up layer at slab edges abutting walls. Seal with manufacturer's recommended tape or secure edge with non-corrosive termination bar.
- E. Seal all penetrations (including pipes, reinforcing steel, and permanent utilities) with manufacturer's pipe boot or vapor barrier manufacturer's recommended detail.
- F. Do not puncture vapor barrier. No punctures or unsealed penetrations are permitted.
- G. Repair damaged areas by cutting patches of vapor barrier, overlapping damaged area 6 inches and taping all four sides with tape.

End of Section

Section 07 31 13
ASPHALT SHINGLES
(FILED SUB-BID REQUIRED AS PART OF SECTION 07 00 02)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Sub-Bid Requirements: As provided under Section 07 00 02 – ROOFING AND FLASHING FILED SUB-BID REQUIREMENTS and supplemented under the Bidding Requirements, Contract Forms, and Conditions of the Contract, and applicable parts of Division 1 - GENERAL REQUIREMENTS.
 - 1. Work of this Filed Sub-Bid includes all individual specification sections listed in Section 07 00 02.

1.2 SUMMARY

- A. Strip existing roofing and building paper where indicated for installation of work of this Section.
- B. Furnish and install:
 - 1. Asphalt shingle roof.
 - 2. Moisture shedding underlayment, eave, valley and ridge protection.
 - 3. Continuous ridge vents.
 - 4. Aluminum drip edge and trim at roof perimeter.

1.3 RELATED REQUIREMENTS

- A. Section 06 10 00 - ROUGH CARPENTRY: Wood blocking, nailers, roof sheathing.
- B. Section 07 62 00 - SHEET METAL FLASHING AND TRIM: Flashing, gutters, and miscellaneous sheet metal work.

1.4 REFERENCES

- A. Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
 - 1. AAMA 2603 - Performance Requirements and Test Procedures for Pigmented Organic Coatings on Extruded Aluminum (as amended).
 - 2. ASTM D 226 - Asphalt Saturated Felt Used in Roofing and Waterproofing.
 - 3. ASTM D 2822 - Asphalt Roof Cement.
 - 4. ASTM D 3018 - Class A Asphalt Shingles Surfaced with Mineral Granules.
 - 5. UL 580 - Tests for Wind Uplift Resistance of Roof Assemblies.
 - 6. UL 790 - Tests for Fire Resistance of Roof Covering Materials.
- B. The following reference materials are hereby made a part of this Section by reference thereto:

1. ARMA (Asphalt Roofing Manufacturers Association) - Residential Asphalt Roofing Manual, latest edition.
2. NRCA - Steep Roofing Manual, latest edition.

1.5 SUBMITTALS

- A. Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
 1. Literature: Manufacturer's product data sheets, specifications, performance data, physical properties for each item furnished hereunder. Include manufacturer's installation instructions indicating preparation required and installation procedures.
 2. Sample warranty: Provide sample copies of manufacturers' actual warranties for materials furnished under this Section, clearly defining all terms, conditions, and time periods for the coverage thereof.
 3. Samples: Roofing shingles for color selection.

1.6 QUALITY ASSURANCE

- A. Roofing applicator, with a minimum of 3 years documented experience demonstrating previously successful work of the type specified herein.
- B. Perform work in accordance with NRCA Steep Roofing Manual.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Store all materials in accordance with the manufacturer's recommendations. Store rolled goods on clean, raised platforms. Store other materials in dry areas, protected from water and direct sunlight.
- B. Damaged material: Remove any damaged or contaminated materials from job site immediately, including materials in broken packages, or show other evidence of damage, unless Architect specifically authorizes correction thereof and usage on project.

1.8 ENVIRONMENTAL CONDITIONS

- A. Do not install eave edge protection and roofing materials when ambient temperatures are below 45 degrees Fahrenheit.

1.9 WARRANTY

- A. Furnish shingle manufacturer's limited lifetime product warranty under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS.

1.10 EXTRA MATERIALS

- A. Deliver to Owner 25 square feet of extra shingles of color and type installed.

July 11, 2018

PART 2 – PRODUCTS

2.1 ROOFING MATERIALS

- A. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, the following roofing products which may be incorporated in the work include:
1. Certaineed Corporation (Saint-Gobain), Valley Forge, PA.
 2. GAF-Elk Corporation, Wayne NJ.
 3. IKO North America, Kankakee IL.
 4. Owens-Corning Fiberglas Corp, Toledo OH.
- B. Asphalt shingles: UL Class 'A' and wind resistant label Self-sealing, laminated, mineral granule surfaced, glass fiber mat base shingle roofing, in color as selected by Architect, conforming to ASTM specifications: D 3018 Type I and D 3462, having a minimum weight of 400 pounds per roofing square and furnished with a limited lifetime manufacturers product warranty. Acceptable products include the following:
1. Certaineed, product "Grand Manor Shangle".
 2. GAF-Elk Corporation, product "Camalot".
 3. IKO, product "Cambridge LT".
- C. Ridge tiles: Furnish manufacturer's nominal 12 by 12 inch compatible hip and ridge shingles in color match roof shingles.

2.2 PROTECTION MEMBRANE

- A. Membrane for ice-dam and wind-blown rain protection: Sheet barrier of rubberized membrane bonded to sheet polyethylene, minimum 40 mil (1.00 mm), total thickness, with strippable treated release paper in compliance with ASTM D1970; having the following minimal characteristics:
1. Minimum tensile strength: 250 pounds per square inch (tested in accordance with ASTM D 412, Die C modified).
 2. Minimum elongation to ultimate failure: 100 percent elongation tested in accordance with ASTM D 412, Die C modified.
 3. Unaffected pliability when tested per ASTM D 1970 over 180 degree bend at minus 20 degrees Fahrenheit (-29°C.).
 4. Minimum adhesion of 3 pounds per inch width (528 N/m), tested per ASTM D903 to plywood.
 5. Maximum permeance when tested in accordance with ASTM D96, 0.05 perms (2.9ng/m²sPa).
 6. Subject to conformance with the above requirements, acceptable products include the following:
 - a. W.R. Grace Company, Cambridge MA, product "Ice & Water Shield".
 - 1) Manufacturer's recommended primer is required for application over orientated strand board (OSB) sheathing: Grace product "Perm-A-Barrier WB Primer".
 - b. Carlisle Coatings and Waterproofing Inc., Wylie, TX, product "WIP 400".

- 1) Manufacturer's recommended primer is required for application at temperatures below 40 degrees F. and for substrates as recommended by manufacturer: Carlisle product "CCW-702".
- c. Henry Company, Huntington Park, CA., product "Ice & Water Barrier, RF200".
 - 1) Manufacturer's recommended primer is required for application at temperatures below 40 degrees F. and for substrates as recommended by manufacturer: Henry product "Blueskin Primer".

2.3 ACCESSORIES

- A. Ridge and hip vent: Rigid, UV stabilized polypropylene, low profile continuous type, providing a minimum of 18 square inches of air flow area per linear foot of vent, designed for use with cap shingles.
 1. Air Vent Inc. (Certainteed), Dallas, TX, product "Shinglevent II".
 2. Cor-A-Vent, Mishawaka, IN, product "V600".
- B. Ridge vent at vertical walls: Continuous type formed metal, with internal air baffles, providing at least 9 square inches of air flow area per linear foot of vent.
 1. Air Vent Inc. (Certainteed), Dallas, TX, product "Flash Filter Vent FV162", color as selected by Architect.
- C. Aluminum drip edge: Shop finished ASTM B 209 sheet aluminum.
 1. Applications: Sheet material shall have the following minimum thickness as specified herein below, for the applications indicated
 - a. Drip edge flashings and trim: 0.050 inch thick.
 - b. Shop-applied thermo-set siliconized polymer coating conforming to AAMA 2603 Coating shall be applied to 0.8 mils dry film thickness in color selected from manufacturer's full available library of colors.
- D. Nails, to install roofing: Standard round wire shingle type, hot dipped zinc coated steel, minimum 13/64 inch head diameter and 0.080 inch shank diameter, of sufficient length to penetrate through roof sheathing.
- E. Nails, to install flashing: Standard round wire roofing type, hot dipped zinc coated steel, minimum 19/64 inch head diameter and 0.104 inch shank diameter, of sufficient length to penetrate 1/2 inch into wood substrate.
- F. Tape, plastic cement, fibrated lap cement, bituminous paint or other accessories required for the proper and complete installation for Work shall be as recommended by roofing manufacturer and eave protection manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that roof penetrations and plumbing stacks are in place and flashed to deck surface.
- B. Verify deck surfaces are dry, free of ridges, warps, or voids. Roofing installer shall report in writing to the Contractor with copy to Architect, any condition which might

adversely affect installation. Proceed with Work of this Section when defects have been corrected and installation conditions are satisfactory.

- C. Beginning of installation means acceptance of existing substrate and site conditions.

3.2 PREPARATION

- A. During the operation of work of this Section, protect existing finishes against undue soilage and damage by the exercise of reasonable care and precautions. Protect from spillage of roofing materials and prevent materials from entering and clogging drains and conductors.
- B. Clean, or repair all existing materials which are soiled or otherwise damaged by Work of this Section, to match original profiles and finishes. Existing materials and finishes which cannot be cleaned, or repaired shall be removed and replaced with new work to match existing.
- C. Fill knot holes and surface cracks with latex filler at areas of bonded eave protection.
- D. Broom clean deck surfaces under eave protection and underlayment.

3.3 INSTALLATION OF PROTECTION MEMBRANE

- A. Preparation:
 - 1. New substrate: Remove all dust, dirt, loose nails and other protrusions from the deck/sheathing.
 - 2. Existing substrate: Remove all old roofing materials and nails from deck area. Sweep thoroughly to remove dust and dirt.
 - 3. Concrete substrate: Prime surfaces with manufacturer's recommended water-based primer.
- B. General: Apply protection membrane in accordance with manufacturer's instructions, starting application at low point and working upwards. At ridges and valley, start a center and work outwards. Lap sides a minimum of 3-1/2 inches (90 mm) and lap ends 6 inches (150 mm).
 - 1. Extend protection membrane over decking for 100 percent coverage beneath asphalt shingle roofing system.

3.4 INSTALLATION OF UNDERLAYMENT

- A. Place on ply of underlayment over area not protected by eave protection, with ends and edges weather lapped a minimum of 4 inches. Stagger end laps of each consecutive layer. Nail in place.
- B. Install protective underlayment perpendicular to slope of roof and weather lap a minimum of 4 inches over eave protection.
- C. Weather lap and seal watertight with plastic cement, items projecting through or mounted on roof.

July 11, 2018

3.5 INSTALLATION OF METAL FLASHING

- A. Weather lap joints a minimum of 2 inches and seal weather tight with plastic cement.
- B. Secure flange with nails spaced 6 inches on center, conceal fastenings.
- C. Flash and seal work projecting through or mounted on roofing with plastic cement, weather tight.

3.6 INSTALLATION OF RIDGE VENT

- A. Cut slotted opening in roof sheathing at peak, 1-1/2 inches wide (3/4 inch wide on both sides of peak). Slot shall be continuous to gable ends, maintaining a minimum of 12 inches of sheathing at gable ends.
- B. Install ridge vent continuous along ridges indicated, in accordance with manufacturer's instructions. Mitre joints in vents at intersecting ridges, for continuous visual line. Top ridge vent with cap roofing. Secure ridge vents using minimum 2-1/2 inch length roofing nails, nailing through baffle. Provide not less than 4 nails per ridge vent unit, one per corner.

3.7 INSTALLATION OF ASPHALT SHINGLES

- A. General: Install shingles in accordance with manufacturer's written instructions and NRCA - Steep Roofing Manual, latest edition.
- B. Install shingles over building felt, with 5 inch exposure and 2 inch headlap. Provide 4 nails per shingle, nails shall be 3/4 inch length so as not to protrude through roof sheathing.
 - 1. Place shingles in straight coursing pattern.
 - 2. Project first course of shingles 3/4 inch beyond fascia boards.
 - 3. Install rain diverters above all doors and walkways.
 - 4. Coordinate installation of roof mounted components or work projecting through roof with weather tight placement of counter flashings.
 - 5. Install ridge cap shingles over ridge vent as recommended by vent manufacturer, and trim shingles flush with edge of vent.
 - 6. Ensure roofing shingles cover protection membrane at valleys; protection membrane is not a permanent weathering surface.
 - 7. Complete installation to provide weather tight service.

3.8 CLEANING

- A. Upon completion of the work of this Section in any given area, remove tools, equipment and all rubbish and debris from the work areas and on-grade areas below; leave in broom-clean condition.

End of Section

Section 07 46 46
FIBER CEMENT SIDING

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish and install:
 - 1. Factory-finished mineral fiber cement clapboard siding, mouldings and trim.
 - 2. Factory prefabricated mineral fiber cement mounting blocks for utilities and through wall penetrations at fiber cement siding.
 - 3. Rainscreen drainage mat system.
- B. Touch-up factory paint finish where damaged and paint over all exposed nail heads to match siding finish.

1.2 RELATED REQUIREMENTS

- A. Section 06 10 00 - ROUGH CARPENTRY.
- B. Section 07 92 00 - JOINT SEALANTS: Sealant, other than those specified herein.

1.3 SUBMITTALS

- A. Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
 - 1. Literature: Manufacturer's product data sheets, specifications, performance data, installation instructions for hardware, adhesives and accessories furnished hereunder.
 - 2. Selection Samples: mineral fiber cement siding color chain.
 - 3. Verification Samples: 12 inch length pieces of specified mineral fiber cement siding and trim, in texture, and widths shown and specified herein.
 - a. Provide samples in color(s) selected by Architect.

1.4 QUALITY ASSURANCE

- A. Discard lengths of material which are unsound, warped, bowed, twisted, improperly treated, or too small to fabricate work with minimum of joints or optimum jointing arrangements, or which are of defective manufacture with respect to surfaces, sizes or patterns.

1.5 FIELD SAMPLES

- A. Provide field sample panel for illustrating factory-applied finishes on mineral fiber cement clapboards.
 - 1. Fabricate panel from 3/4 inch plywood; mount clapboard on one side and trim on two edges with 1 by 4 inch #2 common pine.

July 11, 2018

1.6 DELIVERY, STORAGE AND HANDLING

- A. Ship and handle all materials in a manner which will prevent damage; protect edges and corners from chipping.
- B. Stack mineral fiber cement siding and trim on edge or lay flat on a smooth, level dry surface. Store sheets under cover and keep dry prior to installing.

1.7 WARRANTY

- A. Furnish the following warranties under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS:
 - 1. Provide manufacturer's 50 year transferable limited materials warranty, covering mineral fiber board plank (clapboard) siding, providing coverage for:
 - a. Damage in siding resulting from defects in material and fabrication.
 - b. Cracking, rotting, or delamination.
 - c. Damage from hail.
 - 2. Provide manufacturer's 30 year transferable limited materials warranty, covering mineral fiber board plank shingle siding, providing coverage for:
 - a. Damage in siding resulting from defects in material and fabrication.
 - b. Cracking, rotting, or delamination.
 - c. Damage from hail.
 - 3. Provide manufacturer's 10 year transferable limited materials warranty, covering mineral fiber board trim, providing coverage for:
 - a. Damage in siding resulting from defects in material and fabrication.
 - b. Cracking, rotting, or delamination.
 - c. Damage from hail.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

- A. Performance Requirements:
 - 1. Design system to accommodate, without damage to system, components or deterioration of seals; movement within system; movement between system and perimeter framing components; dynamic loading and release of loads; and deflection of structural support framing.
 - 2. Design to accommodate vertical inter-story movement and provide an allowance for the following tolerances:
 - a. Building floor slab live load differential deflection.
 - b. Structural creep.
 - c. Thermally induced expansion and contraction of framing members.
 - d. Fabrication and erection tolerances.
- B. Fiber cement composition board properties:
 - 1. ASTM Standard Specification C1186 Grade II, Type A.
 - 2. Weight: 2.3 pounds per square foot.

July 11, 2018

3. Flexural strength:
 - a. Along direction of plank: 2300 psi (tested in accordance with ASTM C473).
 - b. Across plank: 2900 psi (tested in accordance with ASTM C473).
4. Tensile strength:
 - a. Along direction of plank: 1600 psi.
 - b. Across plank: 1000 psi.

2.2 SIDING

- A. Basis of Design: To establish a standard of quality, design and function desired, Drawings and specifications have been based on James Hardie Building Products, Inc., Orlando, FL.
 1. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
 - a. James Hardie Building Products, Inc., Orlando, FL.
 - b. Certainteed Corporation, Valley Forge, PA
 - c. Nichiha USA, Inc., Johns Creek, GA.
 - d. Cemboard, Fontana, CA.
- B. Mineral fiber cement composition board "Lap" siding: Cellulose fiber-reinforced cement plank siding with smooth surface texture simulating wood bevel siding, nominal 9-1/4 inches by 5/16 inch (having 8 inch exposure, unless otherwise indicated on the Drawings), factory primed and finished with acrylic paint.
 1. Basis of Design: James Hardie Building Products, Inc., Orlando FL, product "Hardiplank Cedarmill" Lap Siding.
 - a. Finish: Factory primed and field finished.

2.3 ACCESSORIES

- A. Rainscreen drainage mat:
 1. Description: Three dimensional matrix in roll form fabricated from continuous nylon filaments fused at their intersections complying with the following characteristics:
 - a. Material: Nylon 6 or polypropylene.
 - b. Width: nominal 39 inches (991 mm).
 - c. Uncompressed Thickness: Nominal 0.264 inch (6.9 mm) minimum, to 0.44 inch (11mm) thickness maximum.
 - d. Weight: 7.2 ounces per square yard (966.4 g/m²) minimum.
 2. Manufacturer and Products: Subject to compliance with the requirements specified herein, Products which may be incorporated in the work include the following or approved equal:
 - a. Benjamin Obdyke, Inc., Horsham, PA, product: "Home Slicker 10".
 - b. Keene Building Products, Mayfield Heights, OH., product "Driwall Rainscreen 020-1".

- c. Cosella-Dorcken Products, Inc., Beamsville, Ontario, product "Delta-Dry".
 - d. Stuc-O-Flex International, Inc., Redmond WA, product "WaterWay 11mm Rainscreen Drainage Mat".
- B. Trim boards: Cellulose fiber-reinforced cement boards:
- 1. HardieTrim HZ10 custom thickness boards with smooth finish, 1-1/2 inches thick by nominal 12 foot length.
 - 2. HardieTrim 5/4 boards with smooth finish, 1 inch thick by nominal 12 foot length.
 - 3. HardieTrim 4/4 boards with smooth finish, 3/4 inch thick by nominal 12 foot length.
- C. Siding Fasteners : Stainless steel siding nails, 0.091 inch shank with minimum 0.221 inch head, of sufficient length to penetrate into sheathing a minimum of 3/4 inch or full depth.
- D. Fasteners for metal framing: 1-5/8" No. 8-18 x 0.375" head self-drilling, corrosion resistant S-12 ribbed buglehead screws.

2.4 FACTORY FINISH

- A. Factory Finish: Provide manufacturer's factory applied universal primer and baked-on color finish.
- 1. Factory applied finish shall be applied in a climate controlled environment within the fiber cement manufacturer's own facility utilizing a multi-coat, heat cured finish in one manufacturing process.
 - 2. Each finish color must have documented color match to delta E of 0.5 or better between product lines, manufacturing lots or production runs as measured by photospectrometer and verified by a third party.
 - 3. Color(s): As selected by Architect from manufacturer's full range of colors. The Architect reserves the right to select up to two colors.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify adequacy of sheathing, backing and support framing for all siding work.

3.2 INSTALLATION, GENERAL

- A. Install siding in strict accordance with Manufacturer's written instructions and as additionally specified herein. Install claddings to dry surfaces.
- B. Do not fasten mineral fiber cement boards to each other under any circumstance.
- C. Panel Cutting:
- 1. Cut panels using a high speed circular saw with a segmented diamond blade.
 - 2. Cut panels from the front side and protect the face from being damaged during cutting.
 - 3. For incidental cuts, cut panels from the front side using a jigsaw with a carbide tip blade.

4. Provide adequate ventilation during cutting. Use of a dust extractor is recommended.
- D. Drilling:
1. Drilling of holes must be done from the front of the panel using a carbide tip drill bit.
 2. Holes are recommended to be done using a universal drill.
 3. Larger holes, or cut-outs on the panel, can be made by a jig saw with a carbide blade or a hole saw with a diamond blade.

3.3 INSTALLATION RAINSCREEN DRAINAGE MAT

- A. Install in accordance with manufacturer's recommendations and instructions over sheathing and air barrier. Apply trim as required to permit for thickness of rainscreen drainage mat which is nominally 3/8 inch.
1. Install rainscreen drainage mat by butting against window and door trim.
 2. Wherever siding or cladding will be applied, roll out rainscreen with channels running vertically. Cover entire wall surface wherever siding materials will be installed.
 3. Do not stretch rainscreen drainage mat.
 4. Install rainscreen drainage mat so that it lies flat against the wall.
 5. Butt edges of new rolls or new courses together. Do not overlap layers of rainscreen drainage mat.
 6. Nail or staple rainscreen drainage mat every 3 square feet.

3.4 INSTALLATION – SIDING

- A. Starting: Install a minimum 1/4 inch (6 mm) thick lath starter strip at the bottom course of the wall. Apply planks horizontally with minimum 1-1/4 inches (32 mm) wide laps at the top. The bottom edge of the first plank overlaps the starter strip.
- B. Allow minimum vertical clearance between the edge of siding and any other material in strict accordance with the manufacturer's installation instructions.
- C. Align vertical joints of the planks over framing members.
- D. Maintain clearance between siding and adjacent finished grade.
- E. Locate splices at least one stud cavity away from window and door openings.
- F. Use off-stud metal joiner in strict accordance with manufacturer's installation instructions.
- G. Wind Resistance: Where a specified level of wind resistance is required Hardieplank lap siding is installed to framing members and secured with fasteners described in Table No. 2 in National Evaluation Service Report No. NER-405

3.5 INSTALLATION, - TRIM, FASCIA AND MOULDINGS

- A. Install flashing around all wall openings.

July 11, 2018

- B. Fasten through trim into structural framing or code complying sheathing. Fasteners must penetrate minimum 3/4 inch or full thickness of sheathing. Additional fasteners may be required to ensure adequate security.
 - C. Place fasteners no closer than 3/4 inch and no further than 2 inch from side edge of trim board and no closer than 1 inch from end. Fasten maximum 16 inch on center.
 - D. Maintain clearance between trim and adjacent finished grade.
 - E. Trim inside corner with single board.
 - F. Install single board of outside corner board then align second corner board to outside edge of first corner board.
 - G. Allow 1/8 inch gap between trim and siding. Seal gap with high quality, paint-able caulk.
 - H. Shim frieze board as required to align with corner trim.
 - I. Install fascia over structural subfascia.
- 3.6 INCIDENTAL SITE FINISHING – TOUCH UP
- A. Carefully set exposed nails flush with siding.
 - B. Touch-up all blemished siding materials and exposed nails to match original factory finish siding color.
- 3.7 TOLERANCES
- A. Maximum variation for siding from true position of 1/8 inch in 8 feet for plumb.
- 3.8 CLEANING
- A. Daily clean work areas by sweeping and disposing of scraps and sawdust.

End of Section

Section 07 62 00
SHEET METAL FLASHING AND TRIM
(FILED SUB-BID REQUIRED AS PART OF SECTION 07 00 02)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Sub-Bid Requirements: As provided under Section 07 00 02 – ROOFING AND FLASHING FILED SUB-BID REQUIREMENTS and supplemented under the Bidding Requirements, Contract Forms, and Conditions of the Contract, and applicable parts of Division 1 - GENERAL REQUIREMENTS.
 - 1. Work of this Filed Sub-Bid includes all individual specification sections listed in Section 07 00 02.

1.2 SUMMARY

- A. Furnish and install the following:
 - 1. Aluminum flashing.
 - 2. Aluminum gutters and rain leaders (downspouts).
 - 3. Formed brake-metal work.
 - 4. Cap flashings, in conjunction with roofing system sheet membrane base flashings.
 - 5. Sealant in conjunction with sheet metal work specified herein.

1.3 RELATED REQUIREMENTS

- A. Section 06 10 00 - ROUGH CARPENTRY: Wood blocking, nailers.
- B. Section 07 31 13 - ASPHALT SHINGLES.
- C. Section 07 92 00 - JOINT SEALANTS: Sealant and backing material not specified herein.
- D. Flashing sleeves and collars for mechanical and electrical items protruding through roofing: By respective trade sections furnishing same.

1.4 REFERENCES

- A. Referenced Standards: Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. The standards referenced herein are included to establish recognized minimum quality only. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern. Equivalent quality and testing standards will be acceptable, subject to their timely submission, review and acceptance by the Architect.
 - 1. ASTM B 209 - Specification for Aluminum Alloy, Sheet and Plate.
 - 2. ASTM B 221 - Specification for Aluminum Extrusions.
 - 3. ASTM D 226 - Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing.

July 11, 2018

4. ASTM D 2178 - Asphalt Impregnated Glass Mat for Roofing and Waterproofing.
5. ASTM D 4586 - Asphalt Roof Cement, Asbestos-Free.

B. Inclusionary References: The following reference materials are hereby made a part of this Section by reference thereto:

1. SMACNA - Architectural Sheet Metal Manual 7th Edition (January 2012), referred to herein as "Sheet Metal Manual".
2. NRCA - Roofing and Waterproofing Manual.

1.5 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the installation of flashings and sheet metal work with the various trades responsible for installing interfacing materials, and install the work at appropriate times so as not to delay the progress of related work

1.6 SUBMITTALS

A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:

1. Literature: Manufacturer's data sheets for each metal type and accessories furnished hereunder, include material specifications, performance data, physical properties and finishes.
2. Certification: Provide certifications that materials and systems comply with the specified requirements for the use indicated.
3. Shop drawings:
 - a. Fully dimensioned large scale design details showing material profiles, splices, flashing terminations and other jointing details, fastening methods and installation details. Indicate material type, sizes, and weights or gages. Indicate extent of adjacent work specified under other Sections of the Specifications.
 - b. Fully detail methods of relieving stresses due to thermal movement, including sealing of expansion seams.
 - c. All details bearing dimensions of actual measurements taken at the project.
4. Selection Samples:
 - a. Metal sample chips, indicating Manufacturer's full range of finish colors for factory finishes available for selection by Architect.
 - b. Manufacturer's sample boards for sealant colors.
5. Verification Samples:
 - a. 12 inch long samples of formed fascia, gutters and downspouts.

B. Closeout Submittals: Submit the following under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS.

1. Manufacturer's warranties: Include coverage of materials and installation and resultant damage from failure of installation to resist penetration of moisture.

July 11, 2018

1.7 QUALITY ASSURANCE

- A. Company specializing in fabrication and installation of sheet metal flashing work with minimum 5 years documented experience.
- B. Flashing and sheet metal applicator, with a minimum of 5 years documented experience demonstrating previously successful work of the type specified herein, and approved by product manufacturer.

1.8 DELIVERY, STORAGE AND HANDLING

- A. Store preformed and prefinished material to prevent twisting, bending, or abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.
- B. Prevent contact with materials during storage which may cause discoloration, staining, or damage.

1.9 WARRANTY

- A. Provide the following warranties under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS.

1.10 EXTRA MATERIALS

- A. Provide sufficient quantity of each color finish coat material, for field touch-up work after erection, and pack the additional coating materials with the components to be furnished hereunder.
- B. Clearly label and package extra materials securely to prevent damage.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Aluminum: ASTM B 209 sheet aluminum, having a minimum thickness as specified herein below, for the applications indicated:
 - 1. General exposed-to-weather flashings and trim: 0.050 inch thick.
 - 2. Flashing thicknesses for specific conditions:
 - a. Apron flashing, 0.032 inch thick.
 - b. Base flashing, 0.032 inch thick.
 - c. Window and door head flashing, 0.025 inch thick.
 - d. Roof penetrations: 0.032 inch thick.

2.2 ALUMINUM GUTTERS AND DOWNSPOUTS

- A. General: Gutters and downspouts shall conform to requirements of AAMA Specification 1405.1 - Specifications for Aluminum Gutters and Downspouts.
- B. Gutter: Factory formed sectional gutters fabricated from type 3005 - H25 aluminum having a minimum tensile strength of 26,000 psi. Basis of Design: Alcoa Building Products, Pittsburgh, PA., product: "Envoy Gutter Coil", or approved equal.

1. Gutter: 5 inch ogee profile continuous-seamless aluminum gutter, with wall thickness of 0.032 inches.
 2. Inside and Outside corners: wall thickness of 0.032 inches
 3. End caps: 0.024 inch thick aluminum, finished to match gutters.
 4. Provide gutters with factory fabricated inside and outside corners.
 5. Expansion joint material: Aluminum Lined with Neoprene.
- C. Strap hangers, 0.032 inch thick aluminum, or as otherwise recommended by gutter manufacturer, provided with roof aprons.
- D. Downspouts: Nominal 3 by 4 inch rectangular preformed and prefinished 0.024 inch thick alloy 3005, H25 temper aluminum sheet stock having a minimum yield strength of 27,000 pounds per square inch.
1. Downspout clips: 0.025 inch thick aluminum, finished to match downspouts.
- E. Roof Aprons, same materials and finish as downspouts.
- F. Finish: standard two coat baked-on high performance acrylic enamel finish, applied over corrosion inhibiting primer, in manufacturer's standard and 'select' colors, as selected by the Architect, equal to Alcoa system "Alumalure 2000 Finish".

2.3 ACCESSORIES

- A. Membrane for ice-dam and wind-blown rain protection ("Protection Membrane"): Sheet barrier of high density cross laminated polyethylene with butyl-based rubber adhesive, with strippable silicone-coated release sheet.
1. Acceptable products include the following or approved equal:
 - a. Basis of Design: W.R. Grace Company, Cambridge MA., product "Grace Ice & Water Shield HT".
 - b. Firestone Building Products, Indianapolis, IN., product "Clad-Gard SA"
 - c. SDP Advanced Polymer Products Inc., Toronto Canada, product "Palisade SA-HT".
- B. Flashing cement: Trowel grade, composed of selected asphalt, solvents, and non-asbestos fillers, conforming to FS SS-C-153 Type 1, ASTM D 2822, Type 1 and ASTM D 4586, Type 1 (Non-asbestos) as manufactured by Karnak Chemical Corporation, product N^o. 19 "Flashing Cement", or equal as manufactured by Koch Materials Company, J & P Petroleum Products Company or other approved manufacturer.
- C. Nails shall not be smaller than N^o.2 of 12 stub gauge (1.109 inches), with large flat heads, and of sufficient length to penetrate the wood nailers a minimum of 7/8-inch. Nails shall be stainless steel.
- D. Screws: Stainless steel wood screws, of sizes most appropriate for the specific application, and equipped with soft neoprene washers.
- E. Plastic cement as recommended by roofing manufacturer and eave protection manufacturer.

July 11, 2018

2.4 FABRICATION - GENERAL

- A. Form flashings as required, or to profiles indicated on the Drawings, to protect materials from physical damage and shed water.
- B. Form sections square and accurate to profile, in maximum possible lengths, free from distortion or defects detrimental to appearance or performance. To the greatest extent applicable, fabricate sheet metal components in shop, and thoroughly clean all joints on both sides of the sheet metal work.
- C. Fabricate cleats and starter strips of same material as sheet.
- D. Seams: Fabricate nonmoving seams with flat-lock seams.
 - 1. Coated / finished metals: Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use
- E. Form pieces in longest practical lengths, with flat lock seams. Hem exposed edges on underside 1/4 inch, miter and seam corners.
- F. Fabricate corners from one piece with minimum 18 inch long legs, solder for rigidity, seal with sealant.

2.5 FINISHES

- A. Aluminum gutters downspouts, exposed trim and any other aluminum indicated for enamel or color finish: Shop-applied polyvinylidene fluoride enamel finish system equal to PPG Industries, Product: "Duramar", applied as follows, in the selected colors.
 - 1. Prime all surfaces with a corrosion resistant, epoxy-based primer compatible with finish coating, minimum 2.0 mils dry film thickness, fully oven-cured.
 - 2. Provide a finish coating of polyvinylidene fluoride enamel on all exposed surfaces, including all exposed screws, fastenings, with a minimum coating of 1.0 to 1.3 mils. dry film thickness.
 - 3. Provide a clear top coating of polyvinylidene fluoride enamel on all exposed surfaces, including all exposed screws, fastenings, with a minimum coating of 1.0 to 1.3 mils. dry film thickness.
 - 4. Ensure that all coatings, proposed to be applied hereunder, are compatible with the receiving substrate material for each condition, thoroughly clean, and treat aluminum by chromate process.
- B. Aluminum components not indicated for enamel or color finish: Mill finish.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify roof openings, curbs, pipes, sleeves, ducts, or vents through roof are solidly set, cant strips and reglets in place and nailing strips located.
- B. Beginning of work shall constitute acceptance of the conditions of the surfaces to which this work is to be applied.

July 11, 2018

3.2 PREPARATION

- A. Field measure site conditions prior to fabrication.
- B. Install starter and edge strips, and cleats before starting installation.
- C. Install surface mounted reglets true to lines and levels. Seal top of reglets with sealant.
- D. Insert flashings into reglets to form tight fit. Secure in place with plastic wedges at maximum of 8 inches on center. Seal flashings into reglets with sealant.
- E. Secure flashings in place using concealed fasteners. Use exposed fasteners only in locations where approved by Architect.
- F. Cleat and seam all joints. Apply plastic cement compound between metal flashings and felt flashings, asphalt shingle roofing or asphalt roll roofing.
- G. Seal all metal joints watertight.
- H. Coat concealed side of uncoated-aluminum and stainless-steel sheet metal flashing and trim with dampproofing mastic where flashing and trim contact wood, ferrous metal, or cementitious construction. Fit flashings tight in place. Make corners square, surfaces true and straight in planes, and lines accurate to profiles.
- I. During the installation of work of this Section, protect the work of other trades against undue soilage and damage by the exercise of reasonable care and precautions. Repair or replace any work so damaged and soiled.

3.3 FLASHING INSTALLATION - GENERAL

- A. Except as otherwise shown on the reviewed shop drawings or specified herein, the workmanship of sheet metal work, method for forming joints anchoring, cleating, provisions for thermal movement, shall conform to the standard details and recommendations of the sheet metal producer and those of producer organizations and research institutions and associations concerning the sheet metal used, in addition to the standards and details set forth in the referenced materials specified this Section.
- B. Face nailing will not be permitted, concealed cleating or other concealed method must be used to attach sheet metal work to structure.
- C. Ensure that fastenings do not exceed 8 inches on centers. Use flat head fasteners throughout, and seal all fastener heads after installation thereof.
- D. Fill all slip joints and overlapping surfaces in the assembly with specified sealant material, removing all excess sealant material from the prefinished surfaces immediately, to prevent staining the finish.

3.4 INSTALLATION HEADER FLASHING

- A. Install specified aluminum flashing at window heads, piping, vents and all other projections from vertical surfaces where rain water may accumulate. Flashing shall be of continuous length for full width of window head, joints in flashing is not

acceptable. Flashing shall extend behind air infiltration barrier a minimum of 3 inches up the wall.

3.5 INSTALLATION - ALUMINUM GUTTER AND DOWNSPOUTS

- A. Install gutter and downspout following manufacturer's recommendations.
 - 1. Prevent contact between aluminum and dissimilar materials.
- B. Install gutter with two screw-shank fasteners at maximum 30 inch on-center spacing. Provide expansion joints at all gutter runs exceeding 40 feet and on all sides of hip roofs.
- C. Mount downspouts in place in locations where approved by Architect.

3.6 CLEANING

- A. Daily clean work areas by sweeping and disposing of debris.
- B. Upon completion of the work of this Section in any given area, remove tools, equipment and all rubbish and debris from the work area; leave area in broom-clean condition.

End of Section

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Section 07 84 00
FIRESTOPPING

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. The BIDDING REQUIREMENTS, CONTRACT FORMS, and CONTRACT CONDITIONS as listed in the Table of Contents, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. Furnish and install fireproof firestopping, firesafing materials, smoke seals and related accessories required for this Project for all penetrations through fire resistance rated construction, including, but not limited to, penetrations for plumbing, fire suppression, heating, ventilating and air conditioning, electrical systems, and specialized equipment.
 - 1. Fire resistance rated construction requiring firestopping includes, but is not limited to: floors, rated partitions, smoke barriers, smoke partitions, partitions in rated corridors, passageways and stairs, shaft partitions, shaft wall (vertical and horizontal), area separation fire walls, party wall systems, and temporary fire resistant rated partitions and barriers.
 - 2. Provide removable temporary firestopping (pillows) as required to maintain fire integrity prior to Owner's final acceptance, to permit installation of electrical, telephone, data and sound system wiring. Replace temporary firestopping with permanent, after wiring systems are completed.
- B. Furnish and install firestopping/smoke seals at construction joints occurring at tops of fire resistance rated partitions, smoke partitions, and temporary partitions between top of partition and underside of deck above.
- C. Furnish and install all firestopping, firesafing, and smoke seals at perimeter of floor/roof construction and exterior wall systems, as indicated and where required by applicable codes.
- D. Furnish and install all firestopping, firesafing, and smoke seals at expansion joints in chase walls where expansion joints are not exposed to view.
- E. Furnish and install all firestopping, firesafing, and smoke seals where required by applicable codes and as additionally required by authorities having jurisdiction at no additional cost to the Owner.

1.3 RELATED REQUIREMENTS

- A. Section 01 73 29 - CUTTING AND PATCHING: Procedural and administrative requirements for cutting and patching.
- B. *(refer to notes on Structural Drawings, section not bound herewith).*

July 11, 2018

- C. Section 09 29 00 - GYPSUM BOARD: Gypsum wallboard fireproofing.
- D. Division 21 - FIRE SUPPRESSION: Fire protection system penetrations through fire resistance rated construction.
- E. Division 22 - PLUMBING: Plumbing system penetrations through fire resistance rated construction.
- F. Division 23 - HEATING, VENTILATING AND AIR CONDITIONING: Heating, ventilating and air conditioning system penetrations through fire resistance rated construction.
- G. Division 26 - ELECTRICAL: Electrical penetrations through fire resistance rated construction.

1.4 REFERENCES

- A. Referenced Standards: Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. The standards referenced herein are included to establish recognized minimum quality only. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern. Equivalent quality and testing standards will be acceptable, subject to their timely submission, review and acceptance by the Architect.
 - 1. ASTM E-84 - Test Method for Surface Burning Characteristics of Building Materials.
 - 2. ASTM E-119 - Method for Fire Tests of Building Construction and Materials.
 - 3. ASTM E-814 - Test Method of Fire Tests of Through-Penetration Firestops.
 - 4. NFPA 70 - National Electrical Code.
 - 5. UL - Fire Resistance Directory.
 - 6. UL 1479 - Fire Tests of Through Penetration Firestops.

1.5 PERFORMANCE REQUIREMENTS

- A. Provide materials and work to conform to Building Code Requirements in fire resistant wall and floor assemblies.
- B. Manufacturer's certified product test requirements:
 - 1. All firestop/smokeseal material shall be tested by a recognized, independent testing agency and shall conform to both Flame (F-rating) and Temperature (T-rating) requirements of ASTM E-814.
 - 2. Conform to UL Fire Hazard Classification Requirements.
 - 3. Tested and classified non-combustible per ASTM E-84.
- C. Firestops in place shall be of sufficient thickness, width, and density to provide a fire resistance rating at least equal to the floor, wall, or partition construction into which it is installed.
- D. Non-combustible dams shall be constructed:
 - 1. As necessary to achieve fire rating as tested and rated.

2. In conformance with installation requirements for type of floor, wall, and partition construction.
 3. As recommended by firestop/smokeseal manufacturer.
- E. Combustible damming materials, if used, must be removed after proper curing.

1.6 SUBMITTALS

- A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
1. Product Data: Manufacturer's product data sheets, specifications, performance data, and physical properties.
 - a. Indicate requirements for manufacturer's descriptive data for products and related materials with FM, UL or Warnock-Hersey illustrations showing systems and approval of materials in systems.
 2. Certificates: Manufacturer's written certification stating that firestopping materials, meet or exceed the requirements specified under this Section and that all fire-resistive requirements for the indicated combustibility, Flame (F-rating) and Temperature (T-rating) Ratings have been met.
 3. Manufacturer's installation instructions.
 4. Test reports: Submit fire test reports from recognized, independent testing agent(s) indicating the following:
 - a. Fire test report of firestop material applied to substrate and penetration materials similar to project conditions. Tests to indicate both Flame (F-rating) and Temperature (T-rating) Ratings.
 - b. Test reports of products to be used shall indicate conformance to ASTM E-814.
 5. On-site sample installation to be included in Work: Minimum thirty days prior to application in any area, provide samples of firestop and smoke seal materials and installation in accordance with the following requirements.
 - a. Apply one sample of appropriate firestop and smoke seal material for each different penetration and fire rating required for the work.
 - b. Sample areas will comply with thickness, fire resistance ratings, and finished appearance of the project and applicable fire code.
 - c. Acceptance samples will constitute standard of acceptance for method of application, thickness, and finished appearance for firestop and smoke seal application. The sample(s) shall remain visible during completion of the work and shall remain as part of the completed work.
 6. Shop drawings indicating requirements for penetrations in wall/deck intersections, change of planes, control joints, expansion joints and blank openings.

1.7 QUALITY ASSURANCE

- A. General: Notify the Architect where conflicts apply between referenced standards and existing materials, and existing methods of construction.
- B. Sole Source: Obtain firestop and smoke seal products from a single manufacturer, except as otherwise approved by Architect.

July 11, 2018

- C. Special Inspections: Allow for 3 percent of each type of firestopping system to be removed and inspected for conformance with approved submittals.
 - 1. All firestopping shall be inspected prior to installation of suspended ceilings or concealed by other materials.
- D. Qualifications:
 - 1. Installer: a specialized subcontractor having not less than 3 years documented experience demonstrating previously successful work of the type specified herein.
 - a. The manufacturer of the firestop material shall submit written certification that the firm to be used for the firestop products has been trained in the application of the products by the manufacturer.

1.8 MOCK-UPS

- A. Provide mock-ups under provisions of Section 01 45 00 - QUALITY CONTROL for purpose of verifying quality of firestop installation.
- B. Provide firestop samples and locate as directed. Accepted samples may remain as part of the work.

1.9 DELIVERY, STORAGE AND HANDLING

- A. Deliver and store firestopping materials in original, sealed, packages showing manufacturer's identification and date of packaging.
- B. Store and handle materials following manufacturer's recommended procedures, and in accordance with material safety data sheets.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering similar products include the following, or approved equal:
 - 1. Bio Fireshield (A Division of Rectroseal), Houston TX.
 - 2. Dow Corning Corporation, Midland MI.
 - 3. Hilti, Inc. Tulsa OK.
 - 4. 3M Company, Saint Paul MN.
 - 5. Specified Technologies, Inc., Somerville NJ.
 - 6. Metacaulk, (A Division of Rectroseal), Houston TX.
 - 7. Tremco, Inc., Beachwood OH.

2.2 REGULATORY REQUIREMENTS

- A. Conform to applicable code for fire resistance ratings and surface burning characteristics.
- B. Obtain certificate of compliance from authority having jurisdiction indicating approval of combustibility.

2.3 MATERIALS

- A. Firestop mortar: asbestos free, cementitious mortar, U.L. classified as a "fill, void, or cavity material" for through penetration firestop system when tested in accordance with ASTM/UL1479.
1. Acceptable products, or approved equal:
 - a. Bio Fireshield, product "Novasit K-10".
 - b. Hilti, Inc., product "CP 637 Firestop Mortar".
 - c. Specified Technologies, Inc., product "SSM Firestop Mortar".
 - d. Tremco Inc., product "Tremstop M".
- B. Firestop sealant: Single component, non-combustible firestop sealant, U.L. classified as a "fill, void, or cavity material" for through penetration firestop system when tested in accordance with ASTM E-814/UL1479.
1. Acceptable products, or approved equal:
 - a. Bio Fireshield, product product "Biotherm 100" (Gun Grade) or "Biotherm 200" (Self Leveling).
 - b. Hilti, Inc., product "CFS-S SIL GG" (Gun Grade).
 - c. Specified Technologies, Inc., product "SpecSeal SIL300 Sealant (gun grade)" or "SpecSeal SIL300SL" (Self Leveling).
 - d. 3M Company, product "Fire Barrier Silicone Sealants".
 - e. Tremco Inc., product product "Tremsil" (Gun Grade) or "Tremsil S/L" (Self Leveling).
 2. Sealants will not dissolve in water.
- C. Intumescent firestop sealant and caulks: Acrylic based, water resistant sealant, which will not re-emulsify after drying.
1. Acceptable products, or approved equal:
 - a. Bio Fireshield, product "Biostop 500".
 - b. Hilti, Inc., product "FS-ONE Intumescent Firestop Sealant" or "FS 657 Fireblock".
 - c. Specified Technologies, Inc., product "SpecSeal SSS".
 - d. 3M Company, product "Fire Barrier Caulk CP25WB+".
 - e. Tremco Inc., product "Tremstop 1A".
- D. Firestop putty: sticks or pads.
1. Acceptable products, or approved equal:
 - a. Bio Fireshield, product "Moldable Putty".
 - b. Hilti, Inc., product "CP 767 Speed Strips" or "CP 777 Speed Plugs".
 - c. Specified Technologies, Inc., product "SpecSeal Putty Bars and Pads".
 - d. 3M Company, product "Fire Barrier Moldable Putty".
 - e. Tremco Inc., product "Flowable Putty".

July 11, 2018

- E. Firestop collars: Pre-manufactured fire protective pipe sleeve, UL classified as "fill, void, or cavity material" for through penetration firestop system when tested in accordance with ASTM E-814/UL1479.
 - 1. Provide separated (two piece) firestop collar for application when plastic pipe system is already in place. Provide non-separated firestop collar for application prior to installation of plastic pipe system.
 - 2. Acceptable products, or approved equal:
 - a. Bio Fireshield, product, product "Fireshield Pass-through Device", or "Biostop Intumescent Sleeve."
 - b. Hilti, Inc., product "CP 643 Firestop Collar".
 - c. Specified Technologies, Inc., product "SpecSeal Collars".
 - d. 3M Company, product "Fire Barrier PPD's".
 - e. Tremco Inc., product "Fyrecan sleeve".

- F. Firestop pillows: UL Classified as "fill, void, or cavity material" for through penetration firestop system when tested in accordance with ASTM E-814/UL1479.
 - 1. Acceptable products, or approved equal:
 - a. Bio Fireshield, product "Fireshield Firestop Pillows".
 - b. Specified Technologies, Inc., product "SSB Firestop Pillows".
 - c. Tremco Inc., product "Tremstop P.S".

- G. Wrap strips:
 - 1. Acceptable products, or approved equal:
 - a. Bio Fireshield, product "FS-195".
 - b. Hilti, Inc., product "CP 645-E Endless Wrap Strip, or CP 648-S Firestop Wrap Strip".
 - c. Specified Technologies, Inc., product "Spec Seal Wrap Strip".
 - d. 3M Company, product "Fire Barrier FS195 Wrap Strip".
 - e. Tremco Inc., product "Tremco W.S".

- H. Mineral wool fiber / ceramic wool non-combustible insulation (fire safing):
Conforming to ASTM C665, Type 1, ASTM C612, and ASTM C553 with a minimum density of 4 pounds per cubic foot.
 - 1. Flame Spread Classification: Material shall be classified non-combustible per ASTM E-814.
 - 2. Recycled content of slag:: Use maximum available percentage of material (slag). Mineral wool insulation products incorporated into the work shall contain not less than 75 percent of recycled material (slag) by weight.
 - 3. Acceptable products include:
 - a. Fibrex Insulations Inc. Sarnia Ontario, Canada, product: "Fibrex FBX" Industrial board.
 - b. Rock Wool Manufacturing Company, Leeds, AL, product: "Delta Safing Mineral Wool".
 - c. Roxul, Inc., product "Roxul Safe".
 - d. Thermafiber, Inc. product "Safing 4.0 pcf".

- 4. Accessories: Provide galvanized steel safing clips as required for installation of insulation.
 - I. Elastomeric Firestopping: Non halogenated latex based elastomeric coating applied by airless spray.
 - 1. Acceptable products, or approved equal:
 - a. Bio Fireshield (A Division of Rectroshield), product "Flamesafe FS900+"
 - b. Hilti, Inc., product "CP 672 Speed Spray."
 - c. Specified Technologies, Inc., product "Spec Seal Elastomeric Firestop Spray".
- 2.4 ACCESSORIES
- A. Forming and damming materials: Mineral fiberboard or other type as recommended by firestopping manufacturer.
 - B. Primer, sealant and solvents: As recommended by manufacturer.
 - C. Woven wire mesh: Galvanized 20 gage woven wire mesh "chicken wire" or "poultry fencing", 1 inch spacing.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verification of Conditions: Inspect areas and conditions where firestops are to be installed and notify the Architect of conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected.
 - 1. Beginning of installation means acceptance of existing substrate and project conditions.

3.2 PREPARATION

- A. Surface to receive firestops shall be free of dirt, dust, grease, oil, form release agents, or other matter that would impair the bond of the firestop material to the substrate or penetrating item(s).
- B. Voids and cracks in substrate shall be filled and unnecessary projection removed prior to installation of firestops.
- C. All penetrating items shall be permanently installed prior to firestop installation.
- D. Substrate shall be frost, free and, when applicable, dry.

3.3 INSTALLATION

- A. General
 - 1. Installation of firestops shall be performed by applicators/installers qualified and trained by the manufacturer. Installation shall be performed in strict accordance with manufacturer's detailed installation procedures.

2. Apply firestops in accordance with fire test reports, fire resistance requirements, acceptable sample installations, and manufacturer's recommendations. Meet building code requirements.
 3. Coordinate with plumbing, mechanical, electrical, and other trades to assure that all pipe, conduit, cable, and other items which penetrate fire rated construction have been permanently installed prior to installation of firestops. Schedule and sequence the work to assure that partitions and other construction which would conceal penetrations are not erected prior to the installation of firestops.
 - a. Ensure that all firestopping is inspected prior to installation of suspended ceilings or concealed by other finished materials.
- B. Dam construction
1. Install dams when required to properly contain firestopping materials within openings and as required to achieve required fire resistance rating. Combustible damming material must be removed after appropriate curing. Incombustible damming material may be left as a permanent component of the firestop system.
 2. Placement of dams shall not interfere with function or adversely affect the appearance of adjacent construction.
- C. Installation of single component silicone firestop
1. Apply with manual or powered caulking gun.
 2. Apply minimum 1/2 inch thickness for 2 hour rating. Apply 1/2 inch to both sides of wall penetrations; one side only in floor penetrations.
 3. Use incombustible insulation as required to achieve fire resistance rating.
 4. Surface of gun grade silicone firestop may be tooled using clean, potable water.
 5. Clean excess material off of adjacent surfaces and tools within 10 minutes using either water or Xylol where the use of such would not be hazardous.
- D. Installation of cementitious firestop mortar.
1. Add dry powder to water and mix with mechanical mixer or hand mixing tools as recommended by firestop mortar manufacturer. Allow a average mixing time is 3 minutes and provide a average wet density of 70 pounds per cubic foot, plus or minus 5 PCF.
 2. Do not apply if ambient or substrate temperature is less than 35 degrees Fahrenheit during 24 hours after application.
 3. Wet all surfaces prior to application of firestop mortar.
 4. Mortar may be hand applied or pumped into the opening.
 5. Exposed surfaces shall be finished using conventional plastering tools prior to curing.
 6. When installation around layered cables, it is recommended to increase the fluidity of the firestop mortar to provide a better fill around the cables. Vibrate or move the cables slightly to prevent voids from forming between the cables.
 7. Allow 48 hours for initial cure prior to form removal. For full cure allow 27 days.

8. Wet material may be cleaned with water. Dry material may require scraping or chipping.
- E. Installation of firestop collars (plastic pipe only)
 1. Firestop collars may be surface mounted to a slab or wall or imbedded in Firestop Mortar to a maximum depth of 2 inches.
 2. For wall penetrations with ABS pipe firestop collars must be installed on both sides of the penetration to provide a 2 hour F and T Rating. All other applications required installation on one side only to provide a 2 hour F and T Rating.
- F. Firesafing insulation: Install firestopping safing insulation on safing clips spaced as needed between each stud and floor slab, leaving no voids. Secure safing clips to slab using fasteners recommended by insulation manufacturer. Install sealant over mineral wool in accordance with test requirements.
- G. Conclusion of work day: Wherever work is performed in areas which abut or are adjacent to Owner occupied areas, at the conclusion of the work day ensure that all penetrations and perimeter construction joints are firestopped and that there are no openings, penetrations or construction joints left unprotected.

3.4 LABELING

- A. Identify through-penetration 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.
 1. Include the following information on labels

**WARNING: THROUGH-PENETRATION FIRESTOP SYSTEM-DO NOT DISTURB.
NOTIFY FACILITY MANAGER OF ANY DAMAGE.**

- *Contractor's name, address, and phone number.*
- *Through-penetration firestop systems designation of applicable testing and inspecting agency.*
- *Date of installation.*
- *Through-penetration firestop systems manufacturer's name.*
- *Installer's name.*

3.5 FIELD QUALITY CONTROL

- A. Inspecting Agency: Owner will engage a qualified independent inspecting agency to inspect through-penetration firestop systems and to prepare test reports.
 1. Inspecting agency will state in each report whether inspected through-penetration firestop systems comply with or deviate from requirements.
- B. Proceed with enclosing through-penetration firestop systems with other construction only after inspection reports are issued.
- C. Where deficiencies are found, repair or replace through-penetration firestop systems so they comply with requirements.

July 11, 2018

3.6 SCHEDULE

- A. General: Typical penetrations are indicated below with list of standard firestopping/smokeseal approaches. Actual firestopping materials and combination of materials will vary with size of penetration and with individual firestopping manufacturer's approved UL Design System Requirements. Use only UL Design System materials for each penetration that best matches the wall and floor construction.
1. Where penetrations occur for which no listed UL or WH Design System test exists, obtain from the firestop system manufacturer an engineered system acceptable to the authorities having jurisdiction for firestopping such penetrations. Engineered system from manufacturer shall include a detail drawing showing the engineered system and shall contain no disclaimers.
- B. Single metal pipe (non-insulated) and conduit penetrations through floors:
1. Firestop mortar.
 2. Silicone Firestop sealant.
 3. Intumescent firestop sealant.
 4. Firestop putty, sticks or pads.
 5. Mineral fiber / ceramic wool non-combustible insulation (fire safing) in conjunction with a firestop sealant.
- C. Single metal pipe (non-insulated) and conduit penetrations through walls:
1. (masonry and concrete walls only) Firestop mortar and putty.
 2. Intumescent firestop sealant over mineral fiber / ceramic wool non-combustible insulation (fire safing).
 3. Intumescent firestop sealant with wrap strips.
- D. Multiple metal pipe and conduit penetrations through floors:
1. Firestop mortar and wrap strips.
 2. Intumescent firestop sealant over mineral fiber / ceramic wool non-combustible insulation (fire safing).
- E. Multiple metal pipe and conduit penetrations through walls:
1. Firestop mortar and putty.
 2. (through masonry walls only) Firestop pillows with woven wire mesh.
 3. Silicone Firestop sealant over mineral fiber / ceramic wool non-combustible insulation (fire safing).
- F. Insulated metal pipe penetrations through floors:
1. Firestop mortar and wrap strips.
 2. Silicone Firestop sealant over mineral fiber / ceramic wool non-combustible insulation (fire safing).
 3. Intumescent firestop sealant over mineral fiber / ceramic wool non-combustible insulation (fire safing).
 4. Silicone Firestop sealant over wrap strip.

5. Mineral fiber / ceramic wool non-combustible insulation (fire safing) in conjunction with a firestop sealant.
- G. Insulated metal pipe penetrations (single and multiple) through walls:
1. Firestop mortar with wrap strips.
 2. Intumescent firestop sealant over mineral fiber / ceramic wool non-combustible insulation (fire safing).
 3. Intumescent firestop sealant over mineral fiber / ceramic wool non-combustible insulation (fire safing) and Wrap strips.
 4. (multiple penetrations through masonry walls only) Firestop pillows with woven wire mesh.
- H. Duct penetrations through floors or walls:
1. Rectangular and square ducts: Intumescent firestop sealant over mineral fiber / ceramic wool non-combustible insulation (fire safing), and steel flanges provided under Division 15.
 2. Round ducts: Intumescent firestop sealant over mineral fiber / ceramic wool non-combustible insulation (fire safing).
- I. Combustible plastic pipe and conduit penetrations through floors:
1. Firestop mortar with wrap strips.
 2. Firestop mortar with firestop putty and firestop collars.
 3. Silicone firestop sealant over mineral fiber / ceramic wool non-combustible insulation (fire safing).
 4. Silicone firestop sealant and firestop collars.
 5. Intumescent firestop sealant and firestop collars.
 6. Intumescent firestop sealant over mineral fiber / ceramic wool non-combustible insulation (fire safing) with firestop collars.
 7. (maximum pipe size 2 inches) Intumescent firestop sealant over mineral fiber / ceramic wool non-combustible insulation (fire safing) with wrap strips.
- J. Combustible plastic pipe and conduit penetrations through walls:
1. Intumescent firestop sealant over mineral fiber / ceramic wool non-combustible insulation (fire safing).
 2. Intumescent firestop sealant with firestop collars.
- K. Cable penetrations through floors:
1. Silicone Firestop sealant over mineral fiber / ceramic wool non-combustible insulation (fire safing).
 2. Intumescent firestop sealant over mineral fiber / ceramic wool non-combustible insulation (fire safing).
- L. Cable penetrations through walls:
1. Silicone Firestop sealant over mineral fiber / ceramic wool non-combustible insulation (fire safing).
 2. Intumescent firestop sealant over mineral fiber / ceramic wool non-combustible insulation (fire safing).

3. (single penetrations only) Firestop putty.
 4. (electrical boxes) Firestop pads.
 5. Firestop putty over mineral fiber / ceramic wool non-combustible insulation (fire safing).
- M. Bus ducts through floors:
1. Firestop mortar and wrap strips.
 2. Intumescent firestop sealant over mineral fiber / ceramic wool non-combustible insulation (fire safing) and 28 gage (minimum) steel cover plate.
- N. Blank openings:
1. Firestop mortar.
 2. Silicone Firestop sealant over mineral fiber / ceramic wool non-combustible insulation (fire safing).
- O. Fire rated joints:
1. Silicone Firestop sealant over backer rod or bond breaker.
- P. Construction joints at head of wall/floor assemblies:
1. Silicone Firestop sealant/mastic over mineral fiber / ceramic wool non-combustible insulation (fire safing).
 2. Elastomeric spray over mineral fiber / ceramic wool non-combustible insulation (fire safing).
- Q. Smoke barrier sealant for dampers, fire door frames:
1. Silicone Firestop sealant.
- R. Temporary sealing of openings and penetrations:
1. Firestop putty, sticks or pads.
 2. Firestop pillows.

End of Section

Section 07 92 00
JOINT SEALANTS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. The BIDDING REQUIREMENTS, CONTRACT FORMS, and CONTRACT CONDITIONS as listed in the Table of Contents, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. General: The work of this Section consists of sealants and backing materials where shown on the Drawings, as specified herein, and as required for a complete and proper installation.
 - 1. This Section specifies general requirements, definition of joint sealer types, and application requirements for sealant work specified within other individual specification sections.
- B. Prepare sealant substrate surfaces, including removal of existing sealant and backing, and thorough cleaning of joints.
- C. Furnish and install sealant and backing materials.

1.3 RELATED REQUIREMENTS

- A. Section 01 73 29 - CUTTING AND PATCHING: Procedural and administrative requirements for cutting and patching.
- B. Section 02 41 19 - SELECTIVE DEMOLITION: Removal of existing finishes, partitions and walls as indicated in the Drawings
- C. Section 04 20 00 - UNIT MASONRY.
- D. Section 06 10 00 - ROUGH CARPENTRY.
- E. Section 07 31 13 - ASPHALT SHINGLES: Sealant used in conjunction with the installation of shingle roofing.
- F. Section 07 84 00 - FIRESTOPPING: Firestopping sealants and related backing materials.
- G. Section 08 54 00 – COMPOSITE WINDOWS: Perimeter sealant at exterior of window frames.
- H. Section 08 80 00 - GLAZING: Sealant used in conjunction with setting glass.

July 11, 2018

- I. Section 09 29 00 - GYPSUM BOARD: Application of concealed acoustical sealant used in conjunction with gypsum board work at abutting surfaces (perimeter of partitions and walls).
- J. Section 09 30 00 - TILING.
- K. Section 09 91 00 - PAINTING: Caulks used in preparation of applied finish coatings.

1.4 REFERENCES

- A. The standards referenced herein are included to establish recognized quality only. Equivalent quality and testing standards will be acceptable, subject to their timely submission, review and acceptance by the Architect.
- B. Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
 - 1. ASTM C 717 - Standard Terminology of Building Seals and Sealants.
 - 2. ASTM C 790 – Guide for Use of Latex Sealants
 - 3. ASTM C 804 - Use of Solvent-Release Type Sealants.
 - 4. ASTM C 834 - Latex Sealing Compounds.
 - 5. ASTM C 919 - Use of Sealants in Acoustical Applications.
 - 6. ASTM C 920 - Elastomeric Joint Sealants.
 - 7. ASTM C 962 - Use of Elastomeric Joint Sealants.
 - 8. ASTM C 1193 - Guide for Use of Joint Sealants.
 - 9. ASTM D 1056 - Flexible Cellular Materials - Sponge or Expanded Rubber.
 - 10. ASTM D 3960 - Standard Practice for Determining Volatile Organic Compound (VOC) Content of Paints and Related Coatings
- C. The following reference materials are hereby made a part of this Section by reference thereto:
 - 1. SWRI – Sealant and Caulking Guide Specification.

1.5 SUBMITTALS

- A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
 - 1. Product Data: Manufacturer's product data sheets, specifications, performance data, chemical and physical properties and installation instructions for each item furnished hereunder.
 - 2. Selection Samples: Sample card indicating Manufacturer's full range of colors available for selection by Architect.
 - 3. Verification Samples: 12 inch long samples of sealant for verification of color, installed where directed by Architect.
 - 4. Certificates: Manufacturer's certification that the Products supplied meet or exceed specified requirements.
 - 5. Test and Evaluation Reports:

- a. Compatibility and adhesion test reports: Test reports from sealant manufacturer indicating that sealant proposed for use have been tested for compatibility and adhesion with actual samples of substrates to be used on this project. Include sealant manufacturer's interpretation of test results, and recommendations for primers and substrate preparation specific to this Project.
 - B. Closeout Submittals: Submit the following under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS.
 - 1. Bonds and Warranty Documentation: Manufacturer's standard Warranties and Guarantees.
- 1.6 QUALITY ASSURANCE
- A. General: Notify the Architect where conflicts apply between referenced standards and existing materials, and existing methods of construction.
 - B. Sole Source: Provide sealants from a single manufacturer for all work of this Section to the greatest extent possible. Each individual type of sealant installed in the Work shall be from a single manufacturer.
 - C. Qualifications:
 - 1. Installer/Applicator: Minimum of 3 years documented experience demonstrating previously successful work of the type specified herein.
- 1.7 DELIVERY, STORAGE AND HANDLING
- A. Each container and package must bear an unbroken seal, test number and label of the manufacturer upon delivery to the site. Failure to comply with these requirements shall be sufficient cause for rejection of the material in question, by the Architect and his requiring its removal from the site. New material conforming to said requirements, shall be promptly furnished at no additional cost to the Contract.
- 1.8 SITE CONDITIONS
- A. Do not install single component solvent curing sealant in enclosed building spaces.
 - B. Environmental Requirements: Maintain temperature and humidity recommended by the sealant manufacturer during and 24 hours after installation. Do not proceed with installation of joint sealers under the following conditions:
 - 1. When ambient and substrate temperature conditions are below 40 degrees F.
 - 2. When joint substrates are wet due to rain, frost, condensation, or other causes.
 - C. Do not proceed with installation of joint sealers until contaminants capable of interfering with their adhesion are removed from substrates.
- 1.9 WARRANTY
- A. General: Submit manufacturer's warranties under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS.

- B. Manufacturer's warranties shall guarantee sealants installed are free of manufacturing defects and conforms to the published physical properties and referenced standards effective at time of installation.
 - 1. Sealant performance: Manufacturer's warranties shall include coverage for the following listed failures, when sealants are applied in accordance with manufacturer's written instructions. Warranty to include coverage for:
 - a. Sealant will not become brittle, tear or crack due to normal exposure or normal expansion or contraction.
 - 2. Warranty period:
 - a. Silicone sealants on vertical surfaces: 20 years.
 - b. Urethane sealants on vertical surfaces: 5 years.
 - c. Urethane sealants on horizontal surfaces: 5 years.
- C. Installer's warranty: Provide 3 year warranty or bond which shall include coverage of installed sealant and accessories which fail to achieve air tight and watertight seal, exhibit loss of adhesion or cohesion, or do not cure.
 - 1. Installer's warrant shall include coverage for sealant that fails cohesively or adhesively.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Specified Manufacturers and Products: To establish a standard of quality, design and function desired, Drawings and specifications have been based on the products specified under this section for each individual sealant type, for the applications scheduled at the end of Section, and as may be additionally identified on the Drawings.
- B. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
 - 1. BASF Construction Chemicals (Sonneborn), Shakopee MN.
 - 2. Bostik, Inc., Wauwatosa, WI.
 - 3. Dow Corning Corporation, Auburn MI.
 - 4. Momentive Performance Materials (GE Silicones), Waterford NY.
 - 5. Owens Corning, Toledo, OH.
 - 6. Pecora Corporation, Harleysville PA.
 - 7. Phenomenal Brands, Baltimore, MD.
 - 8. Sika Corp, Lyndhurst NJ.
 - 9. Tremco, Inc., Beachwood OH.

2.2 SEALANT MATERIALS

- A. Sealant Materials, General Requirements:
 - 1. Only use sealant and primers that comply with the following limits for VOC content:

-
- a. Architectural Sealants: 250 g/L.
 - b. Roofing Sealants: 420 g/L.
 - c. Roadway Sealants: 250 g/L.
 - d. Sealant primer: 250 g/L.
2. Sealants containing aromatic solvents, fibrous talc, formaldehyde, halogenated solvents, mercury, lead, cadmium, chromium and their compounds, are not permitted.
- B. Joint Sealer Type AA (Acrylic acoustical): One component acrylic latex, permanently elastic, non-staining, non-shrinking, non-migrating and paintable.
1. Owens Corning, product: "QuietZone Acoustical Sealant."
 2. Pecora, product "AC-20 FTR".
 3. Tremco, product "Tremco Acoustical Sealant".
- C. Joint Sealer Type AP (Acrylic painters caulk): One component acrylic latex caulking compound, conforming to ASTM C 834 Type P, Grade NF, paintable within 24 hours after application, with a minimum movement capability of ± 12.5 percent, equal to one of the following:
1. BASF (Sonneborn), product, "Sonolac".
 2. Tremco, product, "Tremflex 834".
 3. Bostik, product, "Chem-Calk 600".
 4. Pecora, product "AC-20+".
- D. Joint Sealer Type SC (Silicone, general construction): One-part medium modulus, natural cure, synthetic sealant, having a useful life expectancy of at least 20 years, conforming to ASTM C 920, Type S, NS, Class 50, use NT, G, A, M, O with a minimum movement capability of ± 50 percent, equal to the following:
1. Dow Corning, product, "791".
 2. GE Silicones, product, "Silpruf".
 3. Pecora, product, "895".
 4. Sika, product, "Sika Sil-C 995".
 5. Tremco, product, "Spectrem 2".
- E. Joint Sealer Type SM (Silicone, Mildew-resistant): USDA approved one component acetoxy silicone rubber, mildew resistant, acceptable to local health officials, conforming to U.S. Food and Drug Administration regulation 21 CFR 177.2600, and ASTM C 920, Type S, Class 25, Grade NS, use NT,G and A with a minimum movement capability of ± 25 percent, and a Shore A hardness of 20, equal to the following:
1. BASF (Sonneborn), product "OmniPlus".
 2. Dow Corning, product "786".
 3. GE Silicones, product "Sanitary 1700".
 4. Tremco, product "Tremsil 200 Sanitary".
 5. Pecora, product "898NST".

July 11, 2018

2.3 ACCESSORIES

- A. Compressible joint bead back-up: Compressible closed cell polyethylene, extruded polyolefin or polyurethane foam rod complying with ASTM C 1330, Type C, 1/3 greater in diameter than width of joint. Shape and size of compressible back-up shall be as recommended by manufacturer for the specific condition used. Provide one of the following, or equal.
 - 1. Construction Foam Products (Division of Nomaco, Inc.), Zebulon, NC, product "HBR Closed Cell".
 - 2. Industrial Thermo Polymers Ltd., Brampton, Ontario CN, product "ITP Standard Backer Rod".
 - 3. BASF Construction Chemicals (Sonneborn), Shakopee MN, product "Sonolastic Closed Cell Backer Rod".
 - 4. W.R. Meadows Inc., Hampshire, IL, product "Sealtight Kool-Rod".
- B. Primers: Furnish and install joint primers of the types, and to the extent, recommended by the respective sealant manufacturers for the specific joint materials and joint function.
- C. Bond-breaker tape, and temporary masking tape: Of types as recommended by the manufacturer of the specific sealant and caulking material used at each application, and completely free from contaminants which would adversely affect the sealant and caulking materials.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.
- B. Inspect existing joints to be renovated.
 - 1. Verify joint sealants, backing, and other materials containing PCBs and other hazardous materials have been removed.
 - 2. Verify joint substrates and adjoining materials are structurally sound.
 - 3. Verify joints to be renovated can be satisfactorily repaired with specified methods and materials.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. General:
 - 1. Weather conditions must be dry and of the temperature, as recommended by sealant manufacturer, during application operations.
 - 2. Surface receiving work of this section must be absolutely dry and dust free. All joints receiving sealant/caulking materials and primers shall be subject to the approval of the sealant manufacturer for proper use of specified materials.

July 11, 2018

- B. Thoroughly clean all joints, removing all loose mortar, oil, grease, dust, frost, and other foreign materials that will prevent proper adhesion of primers and sealant materials.
 - 1. Clean ferrous metals of all rust and coatings by wire brush, grinding or sandblasting. Remove oil, grease and protective coatings with cleaners recommended by sealant manufacturer.
 - 2. Where sealant is indicated to replace existing, thoroughly remove existing sealant and backing, scrape and clean surfaces. Renovate sealant joints in accordance with manufacturer's instructions and reviewed shop drawings. Remove all existing sealant residue from joint surfaces using chemical cleaners and solvents which are acceptable to sealant manufacturer.
- C. Prime joint substrates, as recommended in writing by joint-sealant manufacturer, as based on preconstruction joint-sealant-substrate tests or as based upon prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.
- D. Verify that joint backing and release tapes are compatible with sealant.
- E. Perform preparation in accordance with ASTM C 804 and C 790 for solvent and latex base solvents, respectively.

3.3 PREPARATION FOR REPLACEMENT OF EXISTING SEALANT

- A. Remove existing joint sealants and backing as shown on drawings and identified during pre-installation conference and inspection (Article 3.1 herein above). Do not remove silicone joints to be recapped and joints to be covered with silicone seals.
- B. Cut existing sealant close to joint edges.
- C. Clean joint with power or hand wire brush, grinding, saw cutting, or solvent cleaning to depth at which replacement backing and sealant are to be installed.
- D. Blow out dust, loose particles, and debris with moisture and oil-free compressed air. Remove any pieces of caulk and backer rod lodged in joint.
- E. Repair deteriorated or damaged substrates as recommended by sealant manufacturer to provide suitable substrate for new sealant. Allow patching materials to fully cure.

3.4 INSTALLATION

- A. General: Conform to SWRI requirements, and sealant manufacturer's written requirements for installation.
- B. Install joint bead back-up in all joints in excess of 5/8-inch depth, and joints that have no back-up therein, placing the joint bead in the joint in a manner that will assure a constant depth 1/8 inch greater than the sealant and caulking material depth tolerances.
 - 1. Set beads into joints continuously, by slightly stretching during placement, to permit compression against sides of joint, without surface wrinkles or buckles.
 - 2. Do not stretch back-up material into joints.

July 11, 2018

- C. Install bond breaker in joints where shown in the Drawings and wherever recommended by the sealant manufacturer to prevent bond of the sealant to surfaces where such bond might impair the Work.
- D. Apply masking tape or other precautions to prevent migration or spillage of materials onto adjoining surfaces.
- E. Apply urethane sealants, silicone sealants, and latex caulking materials into joints in accordance with manufacturer's instructions, using mechanical or power caulking gun equipped with nozzle of appropriate size, with sufficient pressure to completely fill the joints.
 - 1. The depth of sealant and caulking materials shall be in accordance with manufacturer's recommendations for the specific joint function, but in no case exceed 1/2-inch in depth, nor less than 1/4-inch, regardless of the joint width.
 - 2. Maintain the outer edge of the sealant and caulking materials, where side faces of joints are in the same plane, back 1/8-inch from the faces.
 - 3. Apply sealant in continuous beads without open joints, voids or air pockets so as to provide a watertight and airtight seal for the entire joint length.
 - 4. After placement of the sealant and caulking materials, concave-tool the surfaces to uniform density, using a water-wet tool. Do not use detergents or soapy water for the tooling operations.
 - 5. Remove the temporary masking tape immediately after tooling, and before the sealant or caulking material has taken initial set.

3.5 CLEANING

- A. Clean all surfaces of adjacent surfaces which have been marked or soiled by the work of this Section, removing all excess sealant and caulking materials with solvents which will not damage the surfaces in any way.

3.6 PROTECTION

- A. During the operation of sealant work, protect the work of other trades against undue soilage and damage by the exercise of reasonable care and precautions. Repair or replace any work so damaged and soiled.

3.7 SCHEDULE

- A. General: Seal joints indicated and all interior and exterior joints, seams, and intersections between dissimilar materials.
- B. Sealant Colors:
 - 1. Colors for Sealant Types "SC", "SE", and "SM": As selected by the Architect from manufacturer's standard colors.
 - 2. Color for Sealant Types "AA" and "AP": White.
 - 3. In concealed installation, and in partially or fully exposed installation where so approved by the Architect, standard gray or black sealant may be used.
- C. Exterior joints (Listed by primary building material abutting sealant joints):

1. Exterior wood and plastic:

Joint Condition	Sealant Type
a. Wood to wood (painted opaque finishes):	SC
b. Wood to metal:	SC
c. Cellular PVC to adjacent materials:	SC
d. Cellular PVC to Cellular PVC:	SC

2. Exterior PVC:

Joint Condition	Sealant Type
a. PVC to PVC:	SC
b. PVC to wood (painted opaque finishes):	SC

D. Interior joints (Listed by primary building material abutting sealant joints):

1. Gypsum Board:

Joint Condition	Sealant Type
a. Gypsum board to metal or wood trim:	AP
b. Gypsum board to abutting surfaces at exposed tops and bottoms partitions and walls:	AA
c. Gypsum board to masonry:	SC
d. At gaps and spaces between gypsum board to interior door and window frames, penetrating conduits and piping, building specialty items, ductwork, and similar items:	AP
e. Gypsum board to plumbing fixtures:	SM

2. Architectural millwork and casework:

Joint Condition	Sealant Type
a. Casework to abutting materials, kitchens, toilet rooms and similar "wet spaces":	SM
b. Casework to abutting surfaces (except in "wet" spaces):	AP
c. Countertops to abutting wall surfaces and to abutting casework:	SM
d. Countertops to plumbing fixtures and fittings:	SM

3. Interior metal:

Joint Condition	Sealant Type
a. Metal to metal:	SC

4. Interior floor drains:

Joint Condition	Sealant Type
a. Floor drains to concrete slab:	SC
b. Floor drains to resilient sheet flooring:	SC

5. Acoustical ceilings:

Joint Condition	Sealant Type
a. Acoustical ceiling edge angle to irregular wall surface	AP

6. Tile:
- | <u>Joint Condition</u> | <u>Sealant Type</u> |
|--|---------------------|
| a. Tile to tile vertical, and horizontal non-traffic joints: | SM |
7. Interior Wood:
- | <u>Joint Condition</u> | <u>Sealant Type</u> |
|---|---------------------|
| a. Wood to wood (painted opaque finishes) | AP or SC |
| b. Wood to metal | SC |
| c. Wood base to wall surfaces | AP |

End of Section

Section 08 11 13
HOLLOW METAL DOORS AND FRAMES

PART 1 – GENERAL

1.1 GENERAL PROVISIONS

- A. The BIDDING REQUIREMENTS, CONTRACT FORMS, and CONTRACT CONDITIONS as listed in the Table of Contents, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. Furnish the following products to be installed under the designated Sections:
 - 1. Flush UL-Labeled and non-labeled steel doors, complete with internal reinforcing, hardware cut-outs; and provided with glazing openings, where so indicated; installed by Section 06 20 00 - FINISH CARPENTRY.
 - 2. Hollow metal frames for doors, UL-Labeled and non-labeled, complete with internal reinforcing; installed under Section 06 10 00 - ROUGH CARPENTRY.
 - 3. Hollow metal frames for fixed-glazed lites, complete with internal reinforcing; installed by: Section 06 10 00 - ROUGH CARPENTRY.
 - 4. Glazing beads, loosely attached to hollow metal frames and doors, where so indicated, for removal and permanent installation during glazing operations; installed by: Section 08 80 00 - GLAZING.

1.3 RELATED REQUIREMENTS

- A. Section 06 10 00 - ROUGH CARPENTRY:
 - 1. Wood framing, blocking, and nailers.
 - 2. Installation of hollow metal door frames.
- B. Section 06 20 00 - FINISH CARPENTRY: Wood casing and trim; installation of doors and hardware.
- C. Section 07 92 00 - JOINT SEALANTS.
- D. Section 08 14 16 - FLUSH WOOD DOORS: Furnishing wood doors to be installed in hollow metal frames.
- E. Section 08 71 00 - DOOR HARDWARE: Furnishing finish hardware, and installation templates for hardware cut-outs and reinforcing.
- F. Section 08 80 00 - GLAZING: Furnishing and installing glass located in doors and frames.
- G. Section 09 29 00 - GYPSUM BOARD: Gypsum grout fill for hollow metal frames occurring in gypsum drywall assemblies.

July 11, 2018

- H. Section 09 91 00 - PAINTING: Applied finish coatings.
- I. Division 26 – ELECTRICAL: Wiring connections for electrified door hardware.
- J. Building-in of frame anchors to wall and partition construction: By trade responsible for wall and partition erection.

1.4 REFERENCES

- A. Reference Standards: Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
 - 1. ANSI A 117.1 - Specifications for Making Buildings and Facilities Accessible to and Usable by Physically Handicapped People.
 - 2. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames, Frame Anchors and Hardware Reinforcing.
 - 3. ANSI/SDI A250.8 – *R2008* (formerly SDI 100) - Recommended Specifications for Standard Steel Doors and Frames.
 - 4. ANSI/SDI A250.11 – Recommended Erection Instructions for Steel Frames.
 - 5. SDI 111 Series (111A-111F): Recommended Details, Steel Doors and Frames.
 - 6. SDI 117-93: Manufacturing Tolerances for Standard Steel Doors and Frames.
 - 7. NFPA publication 80 - Fire Doors and Windows.
 - 8. NFPA publication 105 – Standard for the Installation of Smoke Door Assemblies.
 - 9. UL publication 10B - Fire Tests of Door Assemblies.
 - 10. UL publication 10C – Positive Pressure Fire Tests of Door Assemblies.
 - 11. UL 1784 – Air Leakage Tests of Door Assemblies.
 - 12. All applicable federal, state and municipal codes, laws and regulations for exits.

1.5 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. General: Coordinate the work of this Section with the respective trades responsible for installing anchorages furnished by this Section; make arrangements for delivery, receipt and installation of inserts and anchorages to prevent delay of the Work.
 - 2. Coordinate the work of this Section with the respective trades responsible for furnishing hardware and installing doors and frames.
 - 3. Ensure that the work performed hereunder is coordinated with issued templates authorized by the hardware supplier.
 - 4. Do not fabricate doors or frames before receiving a copy of the approved hardware schedule, submitted by the hardware supplier, reviewed by the Contractor and accepted by the Architect. Verify that issued templates are

coordinated with the approved schedule; immediately notify the Architect, in writing, of any conflicts.

1.6 SUBMITTALS

- A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
 - 1. Product Data: Manufacturer's product data sheets, specifications, for doors, frames and shop applied finishes.
 - 2. Shop Drawings:
 - a. Door and Frame Schedule: A complete schedule coordinated with, and using same identifier designations as, the door and frame schedule contained in the Contract Drawings.
 - b. Large scale details of each type door and frame construction, indicating all gages, reinforcing, and anchorage.
 - 1) Indicated cutouts for glazing.
 - 3. Certificates: Manufacturer's written certification stating that doors, frames, and all related items to be furnished hereunder, meet or exceed the requirements specified under this Section; that specified galvanized and shop priming has been performed; and that all U.L. fire-resistive requirements for the indicated Labels have been met.
- B. Closeout Submittals: Submit the following under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS.
 - 1. Bonds and Warranty Documentation: Manufacturer's standard warranty.

1.7 QUALITY ASSURANCE

- A. General: Notify the Architect where conflicts apply between referenced standards, specified materials, and methods of construction.
- B. Sole Source: Obtain doors and frames specified in this Section from a single manufacturer.

1.8 DELIVERY, STORAGE AND HANDLING

- A. Delivery and Acceptance Requirements:
 - 1. Prior to shipping, identify each frame and door with a removable metal or plastic label which corresponds with door schedule identifying opening number and location.
 - 2. Do not deliver items to the site, until all specified submittals have been submitted to, and approved by, the Architect.
 - 3. Deliver doors and frames boxed or crated to provide protection during transit and job storage.
 - 4. Inspect doors and frames upon delivery for damage. Minor damage may be repaired provided the refinished items are equal in respects to new work and acceptable to the Architect; otherwise remove and replace damaged items.
- B. Storage and Handling Requirements:

1. Store and handle materials following manufacturer's recommended procedures.
2. Store doors and frames at the building site upright and under cover. Place the units on wood dunnage and cover in a manner that will prevent rust and damage.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
1. Therma Tru LTD., Maumee OH.
 2. Amweld Building Products, Inc., (A Division of Amweld International, LLC), Coppell TX.
 3. Ceco Door Products (A Division of Assa Abloy Group Company), Milan TN.
 4. Curries Company (A Division of Assa Abloy Group Company), Mason City IA.
 5. Republic Doors and Frames, McKenzie TN.
 6. Steelcraft (A Division of Allegion Company), Cincinnati OH.

2.2 DESCRIPTION

- A. Regulatory Requirements:
1. Fire resistance rated door construction shall conform to UL publications 10B and 10C.
 2. Fire resistance rated borrowed light assemblies: NFPA 80.
 3. Corridor door assemblies shall be tested and listed per UL 1784.
 4. 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
 5. Install fire rated door assemblies in compliance with NFPA 80.

2.3 PERFORMANCE CRITERIA

- A. Exterior Openings: Comply ASTM C1363 for minimum thermal ratings. 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.
 - 1) Kerf Type Frames: Thermal properties to rate at a fully operable minimum U-Factor 0.36 and R-Value 2.7, including insulated door, kerf type 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).

2.4 DOORS

- A. General: Refer to the Drawings for design of doors, sizes, glazing cut-outs in doors, and details.
- B. Construction: Full flush commercial type, 1-3/4 inches thick, unless noted otherwise, meeting or exceeding the materials, gages, construction, and testing requirements of the referenced ANSI and SDI publications.
 1. Exterior Door Core Construction: Foamed in place polyurethane and steel stiffened laminated core with no stiffener face welds, in compliance with HMMA 867 "Laminated Core".
 - a. Provide 22 gauge steel stiffeners at 6 inches on-center internally welded at 5 inches on-center to integral core assembly, foamed in place polyurethane core chemically bonded to all interior surfaces. No stiffener face welding is permitted.
 2. Interior Door Core Construction: Manufacturer's standard 99-pound (basis weight) kraft-paper honeycomb.
- C. Interior Doors 1-3/4 inch thick (44.4 mm): ANSI 250.8, Level 2, Model 1 (Full Flush), ANSI A250.4 Physical Performance Level B, (Heavy Duty) having 18-gage, minimum 0.042 inch (1.0 mm) steel faces, with a minimum STC rating of 32.
 1. Fire-rated doors: Modify specified construction to meet all construction requirements required for fire-resistive rating.
 - a. Affix appropriate UL, FM or Warnock Hersey labels to each rated door, indicating applicable rating.
- D. Interior temperature-rise-rated door: ANSI 250.8, Level 3, Model 1 (Full Flush), ANSI A250.4 Physical Performance Level B, (Extra-Heavy Duty) having 16-gage steel faces, Temperature-rise-rated type door, UL Class A.
 1. Fire-rating: UL rated Class A having a tested fire resistance rating of up to 3 hours. Refer to Door Schedule on Drawings for specific ratings required. Modify specified construction to meet all construction requirements required for scheduled fire-resistive rating.
 - a. Affix UL, label to door indicating applicable rating.
 2. Temperature rise rating: Door shall be capable of withstanding a 250 degree Fahrenheit temperature rise for a minimum period of 30 minutes.
 3. Core: Solid slab fire rated gypsum core, permanently bonded to the inside face of each face sheet.
- E. Exterior Doors: ANSI 250.8, Level 3, Model 2 (Seamless), ANSI A250.4 Physical Performance Level B, (Extra Heavy Duty) having 16-gage, 0.058 inch thick (1.46 mm) A60 galvanized steel faces, with a minimum core R-value of 6.25.
 1. Visible edge seams: Epoxy fill edge seams and finish for seamless.

July 11, 2018

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- F. Removable Glazing stops: Rectangular channel sections, not less than 20-gage, 0.032 inch thick (0.8 mm) steel; pre-drilled and loosely attached within the glazing cut-outs with countersunk tamper-resistant stainless steel screws; sized to properly accommodate the designated thicknesses of glass and glazing materials; and external edges set flush with, or slightly behind, door face. Modify glazing stops for UL Label doors to conform with UL fire rating requirements.
 - G. Hardware reinforcing: Welded in place steel reinforcement, hot rolled pickled and oiled steel per ASTM A569. Provide G-60, hot-dipped galvanized reinforcing for all exterior openings, and locations where galvanized doors and frames are scheduled. Reinforcing shall be not less than the following minimum steel thicknesses:
 - 1. Hinges: 7 gage, minimum 0.167 inch (4.2 mm) thick.
 - 2. Closers: Box/channel-shape reinforcing, 14 gage, minimum 0.067 inch (1.6 mm) thick.
 - 3. Locks: Box/channel-shape reinforcing,
 - a. Cylindrical locks: 16 gage, minimum 0.053 inch (1.3 mm) thick.
 - b. Mortise locks: 14 gage, minimum 0.067 inch (1.6 mm) thick.
 - 4. Kick plates: 18 gage, minimum 0.042 inch (1.0 mm) thick.
 - 5. All other hardware: 14 gage, minimum 0.067 inch (1.6 mm) thick.
 - 6. Locations for reinforcing shall be determined from information and templates provided under Section 08 71 00 - DOOR HARDWARE.
 - H. Provide UL approved welded steel astragal at each UL pair of fire doors.
 - I. Fabrication
 - 1. Fabricate exposed faces of door panels from cold-rolled steel only.
 - 2. Fabricate concealed stiffeners, reinforcement, edge channels, louvers and moldings from either cold-rolled or hot-rolled steel (at manufacturer's option).
 - 3. Fabricate doors with hardware reinforcement welded in place.
 - 4. Attach fire rated label to each door unit.
 - 5. Close top and bottom edge of exterior doors with flush end closure. Seal joints watertight.

2.5 HOLLOW METAL FRAMES

- A. General: Refer to the Drawings for various types of frames, sizes, and profiles, UL fire-resistive Label frames, and other characteristics of frames and related items.
 - 1. Frame type (all frames): Shop welded frames with mitered joints arc-welded, reinforced and ground smooth.
- B. Materials for frames, reinforcement, anchors, anchor clips and related items: commercial grade cold-rolled steel conforming to ASTM A109 or commercial grade hot-rolled and pickled steel conforming to ASTM A415.
 - 1. Frame gage:
 - a. Interior frames for Level 1 doors: 18-gage, 0.042 inch thick (1.0 mm), except as otherwise required for specific U.L. Label.

July 11, 2018

2. Anchors for fire-resistive rated frames: Conform to all UL requirements for the specific fire-resistive ratings.
3. Provide the following number of anchors, clips, or bolts, per jamb:
 - a. For frames 7'-6" in height or less: 3 anchors per jamb.
 - b. For frames 7'-6" in height or less and having doors exceeding 3'-0" feet width, and for cross corridor frames: 4 anchors per jamb.
 - c. For frames greater than 7'-6", up to 10'-0" in height: 4 anchors per jamb.
 - d. For frames greater than 7'-6", up to 10'-0" in height, and having doors exceeding 3'-0" feet width, and for cross corridor frames: 5 anchors per jamb.
 - e. For frames over 10'-0' in height: 5 anchors per jamb.

2.6 FABRICATION

- A. General: Do not fabricate materials until all specified submittals have been submitted to, and approved by, the Architect.
- B. Fabrication Tolerances, Maximum variation for doors and frames: Maximum diagonal distortion 1/16 inch measured with straight edge, corner to corner.

2.7 FINISHES

- A. Preparation: Pressure-sand all surfaces of all doors, frames, accessory items, anchors, and related items, to remove blemishes and foreign matter and provide paint grip. Spot-fill imperfections with metallic filler, and sand smooth. Thoroughly clean the surfaces by applying hot or cold phosphate treatment standard with the manufacturer.
- B. Following cleaning apply one dip or spray coat of rust-inhibitive metallic oxide, zinc chromate, or synthetic resin primer to all surfaces, including those which will be concealed after erection. Bake, or oven dry, the primer at time and temperature recommended by the manufacturer for developing maximum hardness and resistance to abrasion.

2.8 FINISHES

- A. Factory finishing: Prepare surfaces and apply one thermoset dip or spray coat of rust-inhibitive metallic oxide, zinc chromate, or synthetic resin primer to all surfaces, including those which will be concealed after erection.

PART 3 - EXECUTION

3.1 ERECTION AND INSTALLATION

- A. Installation of frames and doors, including all accessories and related items furnished hereunder, will be performed under Section 06 10 00 - ROUGH CARPENTRY, and Section 06 20 00 - FINISH CARPENTRY.
 1. Section 06 10 00 - ROUGH CARPENTRY shall place frames in correct position within specified tolerances.

July 11, 2018

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ADDITION/RENOVATION
Halifax, Massachusetts

- B. Final installation of loosely-attached glazing stops will be performed under Section 08 80 00 - GLAZING.

End of Section

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Section 08 14 26
MOLDED WOOD DOORS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. The BIDDING REQUIREMENTS, CONTRACT FORMS, and CONTRACT CONDITIONS as listed in the Table of Contents, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. Furnish four pane, pressed (molded) wood doors complete with hardware cut-outs, for installation under: Section 06 20 00 - FINISH CARPENTRY.

1.3 RELATED REQUIREMENTS

- A. Section 06 10 00 - ROUGH CARPENTRY: Wood framing, blocking, and nailers; installation of steel door frames.
- B. Section 06 20 00 - FINISH CARPENTRY: Wood thresholds, frames, casing and trim; installation of doors and hardware.
- C. Section 08 11 13 - HOLLOW METAL DOORS AND FRAMES: Hollow metal frames scheduled to receive wood doors.
- D. Section 08 71 00 - DOOR HARDWARE: Furnishing finish hardware, and installation templates for hardware cut-outs.
- E. Section 09 91 00 - PAINTING: Applied opaque finish coatings.

1.4 REFERENCES

- A. Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
 - 1. ANSI A 117.1 - Specifications for Making Buildings and Facilities Accessible to and Usable by Physically Handicapped People.
 - 2. ASTM E 152 - Methods of Fire Tests of Door Assemblies.
 - 3. NFPA publication 80 - Fire Doors and Windows.
 - 4. UL 10B - Fire Tests of Door Assemblies.
 - 5. Warnock-Hersey - Certification Listings for fire doors.
 - 6. All applicable federal, state and municipal codes, laws and regulations for exits.

1.5 SUBMITTALS

- A. Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
1. Literature: Fabricator's product data sheets, specifications, performance data, physical properties for each item furnished hereunder.
 2. Certification: Fabricator's written certification stating that doors, meet or exceed the requirements specified under this Section; that specified shop finishing has been performed; and that all fire-resistive requirements for the indicated Labels have been met.
 3. Door schedule: A complete schedule of doors, to be furnished hereunder, coordinated with the schedule contained in the Contract Drawings.
 4. Shop drawings: Elevations, and large scale sections and details of door and frame construction, indicating profiles, joinery and cut-outs for hardware.
 5. Samples:
 - a. Corner section and panel of specified stile and rail type door exhibiting profile of panels, stiles and rails, and joinery.
 - b. For each specie of wood and finish scheduled for transparent finishes: submit two 12 inch long finished samples of each specie of wood specified, in the selected finishes.
 - c. After receipt of color selections from the Architect, submit 12 by 12 inch pieces of tempered hardboard, coated with the actual pigmented prefinishing system to be used, in each selected color.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications:
1. A qualified manufacturer that is a member in good standing of the Window and Door Manufacturers Association.
- B. All materials and workmanship shall conform with Architectural Woodwork Institute (AWI) quality standards in grades as specified herein.
- C. Subject to compliance with the requirements specified herein, fabricators offering stile and rail doors which may be incorporated in the work must be AWI members in good standing.
- D. Product Performance: Provide documents showing compliance to the following WDMA attributes, validating the specified WDMA Performance Duty Level:
1. Adhesive Bonding Durability: WDMA TM-6
 2. Cycle Slam: WDMA TM-7
 3. Hinge Loading: WDMA TM-8
 4. Screw Holding: WDMA TM-10
 - a. Door Face
 - b. Vertical Door Edge
 - c. Horizontal Door Edge (applies when hardware is attached)

July 11, 2018

1.7 SEQUENCING AND SCHEDULING

- A. Coordinate the work of this Section with the respective trades responsible for furnishing hardware and installing wood doors.
- B. Ensure that the work performed hereunder is coordinated with issued templates authorized by the hardware supplier.
- C. Do not fabricate doors before receiving a copy of the approved hardware schedule, submitted by the hardware supplier, reviewed by the Contractor and approved by the Architect. Verify that issued templates are coordinated with the approved schedule; immediately notify the Architect, in writing, of any conflicts.

1.8 DELIVERY, STORAGE AND HANDLING

- A. The Contractor is responsible to make certain that wood doors are not delivered until the building and storage areas are sufficiently dry so that the doors will not be damaged by excessive changes in ambient humidity and relative moisture content.
- B. Deliver wood doors in resilient non-staining moistureproof packaging, provide protection during transit and job storage. Clearly identify doors with door opening number, matching those indicated on the approved Door Schedule.
- C. Inspect doors upon delivery for damage. Minor damage may be repaired provided the refinished items are equal in respects to new work and acceptable to the Architect; otherwise remove and replace damaged items.
- D. Store doors in protected, elevated, dry areas; protect from exposure to sunlight and moisture. Seal top and bottom edges if stored more than one week. Break packaging seal on-site to permit ventilation.

1.9 ENVIRONMENTAL CONDITIONS

- A. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weather tight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining temperature between 50 and 90 degrees F (16 and 32 deg C) and relative humidity between 25 and 55 percent during remainder of construction period.

1.10 WARRANTY

- A. Furnish the following warranties under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS:
- B. Manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Warping (bow, cup, or twist) more than 1/4 inch (6.4 mm) in a 42-by-84-inch (1067-by-2134-mm) section.
 - b. Telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch (0.25 mm in a 76.2-mm) span.
 - 2. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.

3. Warranty Period for Solid-Core Interior Doors: Life of installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Specified Manufacturer: To establish a standard of quality, design and function desired, Drawings and specifications have been based on Masonite North America, Tampa, FL., product: "Classic, Molded Panel Series".
- B. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
 1. Masonite North America, Tampa, FL.
 2. Mohawk Doors, Northumberland, PA.
 3. CMI CraftMaster Interior Doors, Chicago, IL.
- C. Source Limitations: Obtain flush wood doors from single manufacturer.

2.2 MOLDED PANEL WOOD DOORS, GENERAL

- A. Quality Standard: In addition to requirements specified, comply with WDMA I.S.1-A-13, "Architectural Wood Flush Doors."
 1. All doors must meet specified WDMA Performance Duty Level, including face screw holding requirement. Surface applied hardware shall be installed with screws; through bolts are not acceptable. All doors shall meet specified WDMA Performance Duty level, with the exception of face screw holding requirement. Surface applied hardware shall be installed with through bolts.
- B. Smoke- and Draft-Control Door Assemblies: Listed and labeled for smoke and draft control, based on testing according to UL 1784.
- C. Wood-Based Particleboard-Core Doors:
 1. Provide wood-based particleboard core doors with a minimum density per ANSI A208.1, Grade LD-1 as required to meet WDMA Performance Duty level specified without added blocking.

2.3 DOORS FOR OPAQUE FINISH

- A. Interior Solid-Core Doors:
 1. Grade: Premium.
 2. Style: As selected by the Architect from the following options:
 - a. Commercial Series:
 - 1) Four Panel Smooth.
 3. Exposed Vertical Edges: Mill option softwood for painting. Mill option hardwood or SCL. Vertical edges can be one-piece, laminated lumber, or solid lumber.
 4. Horizontal Edges: Mill option lumber or SCL
 5. Thickness: 1-3/4 inches (44mm) or 1-3/8 inches (35mm) as scheduled.
 6. Core: Wood-based Particleboard.

7. Construction: Stiles and rails are bonded to core, and then entire unit is abrasive planed before veneering.

2.4 FABRICATION

- A. Factory fit doors to suit frame-opening sizes indicated. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.
 1. Comply with NFPA 80 requirements for fire-rated doors.
- B. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame Shop Drawings, BHMA-156.115-W, and hardware templates.
 1. Coordinate with hardware mortises in metal frames to verify dimensions and alignment before factory machining.

2.5 SHOP PRIMING

- A. Doors for Opaque Finish: Shop prime faces and vertical edges with one coat of wood primer specified in Document 09 91 23 - INTERIOR PAINTING.
- B. Opaque Finish: Grade: Premium.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine doors and installed door frames, with Installer present, before hanging doors.
 1. Verify that installed frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs. Any deficiencies must be corrected prior to door installation.
 2. Reject doors with defects.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Installation of wood doors, including all accessories and related items furnished hereunder, will be performed under Section 06 20 00 - FINISH CARPENTRY.

3.3 ADJUSTING

- A. Operation: Correct any deficiency that prohibits the door from swinging or operating freely. Do not remove hinge screws after initial insertion. Shims used for alignment purposes must be inserted between hinge and frame. Do not insert shims between hinge and door.
- B. To prevent stile failure, insure that door closers are properly adjusted and do not limit the door opening swing. Limit door opening swing only with a properly located stop.

End of Section

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Section 08 14 33
STILE AND RAIL WOOD DOORS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. The BIDDING REQUIREMENTS, CONTRACT FORMS, and CONTRACT CONDITIONS as listed in the Table of Contents, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SECTION INCLUDES

- A. Furnish stile and rail wood doors, complete with hardware cut-outs and provided with openings for glazing and louvers, where so indicated for installation under: Section 06 20 00 - FINISH CARPENTRY.
 - 1. Provide doors with transparent finish except sides facing bathrooms which are to received field-painted finish.
 - 2. Exterior doors shall be factory glazed where indicated. Refer to Section 08 80 00 – GLAZING for requirements for insulating glass.

1.3 RELATED SECTIONS

- A. Section 06 10 00 - Rough Carpentry: Wood blocking, and nailers; installation of steel door frames.
- B. Section 06 20 00 - Finish Carpentry: Wood thresholds, frames, casing and trim; installation of doors and hardware.
- C. Section 08 11 13 - Hollow Metal Doors and Frames: Hollow metal frames scheduled to receive wood doors.
- D. Section 08 71 00 - Door Hardware: Furnishing finish hardware, and installation templates for hardware cutouts.
- E. Section 08 80 00 - Glazing: Specifications for glazing in doors.
- F. Section 09 91 00 - Painting: Applied opaque finish coatings.

1.4 REFERENCES

- A. Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
 - 1. ANSI A 117.1 - Specifications for Making Buildings and Facilities Accessible to and Usable by Physically Handicapped People.
 - 2. ASTM E 152 - Methods of Fire Tests of Door Assemblies.
 - 3. UL 1784 – Air Leakage Tests of Door Assemblies.

4. WDMA Industry Standard IS 1A-13.
5. Warnock-Hersey - Certification Listings for fire doors.
6. All applicable federal, state and municipal codes, laws and regulations for exits.

1.5 SUBMITTALS

- A. Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
 1. Literature: Fabricator's product data sheets, specifications, performance data, physical properties for each item furnished hereunder.
 2. Certification: Fabricator's written certification stating that doors, meet or exceed the requirements specified under this Section; that specified shop finishing has been performed; and that all fire-resistive requirements for the indicated Labels have been met.
 3. Door schedule: A complete schedule of doors, to be furnished hereunder, coordinated with the schedule contained in the Contract Drawings.
 4. Shop drawings: Elevations, and large scale sections and details of door and frame construction, indicating profiles, joinery and cut-outs for hardware.
 5. Samples:
 - a. Corner section and panel of specified stile and rail type door exhibiting profile of panels, stiles and rails, and joinery.
 - b. For each specie of wood and finish scheduled for transparent finishes: submit two 12 inch long finished samples of each specie of wood specified, in the selected finishes.
 - c. After receipt of color selections from the Architect, submit 12 by 12 inch pieces of tempered hardboard, coated with the actual pigmented prefinishing system to be used, in each selected color.

1.6 QUALITY ASSURANCE

- A. All materials and workmanship shall conform with Architectural Woodwork Institute (AWI) quality standards in grades as specified herein.
- B. Subject to compliance with the requirements specified herein, fabricators offering stile and rail doors which may be incorporated in the work must be AWI members in good standing.

1.7 SEQUENCING AND SCHEDULING

- A. Coordinate the work of this Section with the respective trades responsible for furnishing hardware and installing wood doors.
- B. Ensure that the work performed hereunder is coordinated with issued templates authorized by the hardware supplier.
- C. Do not fabricate doors before receiving a copy of the approved hardware schedule, submitted by the hardware supplier, reviewed by the Contractor and approved by the Architect. Verify that issued templates are coordinated with the approved schedule; immediately notify the Architect, in writing, of any conflicts.

July 11, 2018

1.8 DELIVERY, STORAGE AND HANDLING

- A. The Contractor is responsible to make certain that wood doors are not delivered until the building and storage areas are sufficiently dry so that the doors will not be damaged by excessive changes in ambient humidity and relative moisture content.
- B. Deliver wood doors in resilient non-staining moistureproof packaging, provide protection during transit and job storage. Clearly identify doors with door opening number, matching those indicated on the approved Door Schedule.
- C. Inspect doors upon delivery for damage. Minor damage may be repaired provided the refinished items are equal in respects to new work and acceptable to the Architect; otherwise remove and replace damaged items.
- D. Store doors in protected, elevated, dry areas; protect from exposure to sunlight and moisture. Seal top and bottom edges if stored more than one week. Break packaging seal on-site to permit ventilation.

1.9 FIELD MEASUREMENTS

- A. Verify that field measurements are as indicated on shop drawings.

1.10 WARRANTY

- A. Furnish the following warranties under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS:
 - 1. Limited lifetime warranty for interior and exterior stile and rail doors.
 - 2. Provide written warranty agreeing to replace defective insulating glass units and stating that insulating glass units will be free from condensation, fogging and obstruction of vision due to film on internal surfaces for 10 years from date of installation. Replacement includes labor and materials.
- B. Warranties shall include delamination of veneer, warping beyond specified installation tolerances, defective materials, and telegraphing core construction.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design: To establish a standard of quality, design and function desired, Drawings and specifications have been based on Simpson Door Company, McCleary, WA., product series "French Doors."
- B. Acceptable Manufacturers offering similar products which may be considered as equal, include the following:
 - 1. Simpson Door Company, McCleary, WA.
 - 2. Trustile Doors, LLC. Denver CO.
 - 3. East Coast Custom Doors, South Portland ME.
 - 4. Marshfield Door Systems Inc., Marshfield WI.

2.2 EXTERIOR STILE AND RAIL DOORS AND SIDELIGHTS

- A. General requirements: Conform to the requirements set forth in the designated Sections of the (WDMA) Industry Standard IS 1-A-97, (and the applicable requirements of U.S. Commercial Standard CS 171, as amended. Refer to the Drawings for sizes, locations of each type door, glazing cutouts in doors, and other characteristics of doors to be furnished hereunder.
1. Construction: Prehung, 1-3/4 inches thick, exterior medium density fiberboard (MDF) doors with sticking and panel configurations as indicated on the Drawings or as selected by the Architect from the manufacturer's full range of available profiles.
 2. Panels:
 - a. Wood species: Douglas Fir.
 - b. Simpson "WaterBarrier" (or approved equal) upgrade: Medium density overlay (MDO) over the exterior surface of the door with PVC bars and glazing beads, primed ready for field paint. Wood species on the inside face.
 3. Stiles:
 - a. 1/8 inch thick MDF over laminated veneer lumber. MDF shall be exterior grade MDF manufactured with phenolic resins to resist moisture.
 - b. Provide manufacturer's optional upgrade for bottom stile: Composite block material finger-jointed into the bottom of the stiles eliminates water infiltration, with manufacturer's 5-year warranty
 4. Frames:
 - a. Manufacturer's standard solid wood frame, double rabbeted, with hardware cutouts to receive door and sidelights prehung at factory.
- B. Performance Requirements, manufacturer's standard operating hardware utilized:
1. Air Infiltration: Air leakage shall not exceed 0.15 CFM per square foot of surface area for fixed units and 0.30 CFM per foot of sash crack when tested in accordance with ASTM E283 at differential static pressure of 6.24 psf.
 2. Water Infiltration: No uncontrolled leakage when tested in accordance with ASTM E547 at test pressure of 6.24 psf, or 20 percent of full positive design wind load, whichever is greater.
 3. Forced-Entry Resistance: Comply with Performance Level 10 requirements when tested according to ASTM F588.
 4. Thermal Transmittance: Provide door units with the following U-value as determined according to NFRC 100 or calculated according to LBNL Window 5.2 computer analysis.
 - a. U-value: Comply with Massachusetts State Building Code requirements.
 5. Structural Requirements: When tested in accordance with ASTM E330 at 150 percent of design pressure, no failure or permanent deflection in excess of 0.003 of any member's span after removing the imposed load, for a positive (inward) and negative (outward) design pressure of 60 psf.
- C. Hardware:

July 11, 2018

1. Anchor Bolts and Screws: Hex head through-bolts and flat head wood screws shall be of corrosion resistant type (zinc chromate, galvanized or stainless steel).
2. Waterproof Adhesive: Resorcinol, melamine, or polyvinyl acetate emulsion type.
3. Anchor Clips: Teco, Simpson Strong-Tie Connectors®, or approved equal.
4. Operating Hardware: Refer to Section 08 71 00 – DOOR HARDWARE.
5. Weatherstripping: Extruded ethylene propylene, neoprene or other plastic that remains flexible and non-sticky at project ambient temperature extremes.

D. Wood Finish:

1. Exterior: All corners and edges of units receiving film-forming finishes shall be eased/radiused to promote finish adhesion and maintain proper film thickness.
 - a. One (1) coat factory primed, with additional finish coats applied in field after installation refer to Section 09 91 00 - PAINTING.

2.3 FABRICATION

- A. Fabricate doors to in dimensions, and profiles indicated in the drawings.
 1. Tolerances: Maximum diagonal distortion 1/16 inch measured with straight edge, corner to corner.
- B. Factory machine doors for hardware specified and furnished under Section 08 71 00 – DOOR HARDWARE obtain templates prior to fabricating doors.

2.4 FACTORY FINISHING

- A. AWI Premium Grade Factory Finish System “Conversion Varnish” system having a Medium rubbed effect with a sheen of 24° to 28° gloss units per ASTM D523. Finish system shall not substantially increase flame spread.
 1. One washcoat, reduced conversion varnish.
 2. Colorant, apply as required to match Architect’s control sample.
 3. One coat sealer, conversion varnish.
 4. Two coats topcoat: conversion varnish.
 5. Stain to match Architect’s sample.
- B. Opaque finish: Prime doors with alkyd primer ready for field applied finish coatings.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Installation of wood doors, including all accessories and related items furnished hereunder, will be performed under Section 06 20 00 - FINISH CARPENTRY.
- B. Final installation of loosely attached glazing stops will be performed under Section 08 80 00 - GLAZING.

End of Section

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Section 08 31 00
ACCESS DOORS AND PANELS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. The BIDDING REQUIREMENTS, CONTRACT FORMS, and CONTRACT CONDITIONS as listed in the Table of Contents, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. Fire resistive rated and non-rated access panels and frames, as specified under this Section, furnished by Sections requiring the same and installed under the following Sections:
 - 1. Section 09 29 00 - GYPSUM BOARD: Installation of access panels into drywall assemblies.
 - 2. Section 09 30 00 - TILING: Installation of access panels into tiled walls.

1.3 RELATED REQUIREMENTS

- A. Section 03 30 00 – CAST-IN-PLACE CONCRETE.
- B. Section 09 29 00 - GYPSUM BOARD: Installation of access panels into drywall assemblies.
- C. Section 09 30 00 - TILING: Installation of access panels into tiled walls.
- D. Division 21 - FIRE SUPPRESSION: Furnishing access panels required for fire protection systems.
- E. Division 22 - PLUMBING: Furnishing access panels required for plumbing systems.
- F. Division 23 - HEATING, VENTILATING AND AIR CONDITIONING: Furnishing access panels required for heating/cooling systems.
- G. Division 26 - ELECTRICAL: Furnishing access panels required for electrical systems.

1.4 SUBMITTALS

- A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
 - 1. Product Data: Manufacturer's product data sheets, specifications and installation instructions.
 - 2. Schedule: Submit Schedule of all access panels to be furnished hereunder, indicating locations for each size and type of access door.

- a. The Contractor is responsible to ensure that all of the types/styles of panels and frames specified herein can be furnished by the manufacturer submitted.
 - b. Prior to submitting schedule, coordinate with the work of Division 21 - FIRE SUPPRESSION, Division 22 - PLUMBING, Division 23 - HEATING, VENTILATING AND AIR CONDITIONING and Division 26 - ELECTRICAL and meet with the Architect to determine exact quantities and locations required for the installation of access panels.
3. Shop drawings: Large scale details of access doors, indicating all sizes, gages and thickness; provide complete installation details, coordinated to the specific receiving conditions.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Do not deliver access doors to the site, until all specified submittals have been submitted to, and approved by, the Architect.
- B. Store access door units inside, under cover, and in manner to keep them dry, protected from weather, direct sunlight, surface contamination, corrosion and damage from construction traffic and other causes.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
 1. Acudor Products Inc., Cedar Grove, NJ
 2. Karp Associates Inc., Maspeth NY.
 3. Nystrom Products Company, Minneapolis MN.
 4. Williams Brothers Corporation of America, Front Royal, VA.
- B. Single Source: All work of this Section shall be produced by a single manufacturer, unless otherwise approved by the Architect.

2.2 ACCESS PANELS - GENERAL

- A. Minimum Access Door Sizes, based on access need:
 1. Reach-in access: Minimum size 12 by 12 inches.
 2. Body torso access: Minimum size 24 by 24 inches.
 3. Complete body passage: Minimum size 30 by 30 inches.

2.3 ACCESS PANELS - FOR FIRE RESISTANCE RATED CONSTRUCTION

- A. For fire-resistance rated wall and ceiling surfaces: Standard flush panel door meeting the following requirements:
 1. Panel and frame rating: UL "B" label for 90 minutes.
 2. Frame type:

- a. For tiled walls: 16 gage Type 304 stainless steel flanged frame, with flange exposed to view 1 inch or less, equal to:
 - 1) Acudor FW-5050 series
 - 2) Karp KRP-150FR series.
 - 3) Nystrom IT series.
 - 4) Williams WB-FRSS Regular series.
- b. For gypsum board walls and ceilings: 16 gage galvanized bonderized steel frame, with 22 gage galvanized steel drywall bead.
 - 1) Acudor FW-5050DW
 - 2) Karp KRP-350FR series.
 - 3) Nystrom IW series.
 - 4) Williams WB-FR series.
3. Door: Insulated Flush panel door as follows:
 - a. Typical wall types : Flush door, Sandwich construction with 2 inch thick mineral wool fiber insulation between two layers of 20 gage galvanized bonderized steel.
 - b. For ceramic tile walls only: Flush door, Sandwich construction with 2 inch thick mineral wool fiber insulation between two layers of 20 gage Type 304 stainless steel.
4. Hinge: Flush continuous piano hinge with stainless steel pin.
5. Closer: Spring closer.
6. Latch: Flush cam latch, operated by Allen or Torx head screwdriver.

2.4 ACCESS PANELS - FOR NON- RATED CONSTRUCTION

- A. For non-rated wall and ceiling surfaces (service and non-public areas): Flush panel door type meeting the following requirements:
 1. Frame type:
 - a. For tiled walls: 16 gage Type 304 stainless steel flanged frame, with flange exposed to view 1 inch or less, equal to:
 - 1) Acudor UF-5000 series.
 - 2) Karp DSC-214SM series.
 - 3) Nystrom NT series.
 - 4) Williams WB-GP series.
 - b. For gypsum board walls and ceilings: 16 gage galvanized bonderized steel frame, with 22 gage galvanized steel drywall bead.
 - 1) Acudor DW-5040 series.
 - 2) Karp KDW series.
 - 3) Nystrom NW series.
 - 4) Williams WB-PL series.
 2. Door: Flush panel door as follows:
 - a. Typical all wall types, except tile: 14 gage galvanized bonderized steel.
 - b. For tiled walls: 14 gage type 304 stainless steel.
 3. Hinge:

- a. Typical: Concealed spring hinge enabling door to open 175 degrees and permit removal of door from frame.
- b. Panels greater than 24 by 36 inches: Flush continuous piano hinge with stainless steel pin.
- 4. Latch: Flush cam latch, operated by Allen or Torx head screwdriver.
- B. For non-rated gypsum board, walls and ceilings (Public areas): Recessed door type meeting the following requirements
 - 1. Manufacturer's types:
 - a. Acudor DW-5015 series.
 - b. Karp:
 - 1) Walls: Karp RDW series.
 - 2) Ceilings: Karp KATR series.
 - c. Nystrom RW series.
 - d. Williams WB-DW series.
 - 2. Frame type: 16 gage galvanized bonderized steel frame, with 22 gage galvanized steel drywall bead.
 - 3. Door: Recessed 16 gage galvanized bonderized steel door. with 22 gage galvanized steel drywall bead.
 - 4. Hinge: Concealed pivot rod hinge.
 - 5. Latch: Flush cam latch, operated by Allen or Torx head screwdriver.

2.5 ACCESSORIES

- A. Emergency latch release: For all ceiling panels and wall panels accessible from the back which are greater than 18 by 18 inches in size, provide an interior latch release mechanism to permit panel to be opened from back (interior side) of panel.

2.6 FACTORY FINISHING

- A. Panel assemblies fabricated from stainless steel: N^o. 4 satin finish.
- B. Panel assemblies fabricated from galvanized bonderized steel: Baked on rust inhibitive gray primer finish.
- C. Panel assemblies fabricated from cold rolled steel: Phosphate dipped with baked on rust inhibitive gray primer finish.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Inspect all surfaces and verify that they are in proper condition to receive the work of this Section. Verify that prepared openings are ready to receive the work of this Section and opening dimensions are as indicated on the shop drawings. Verify that all blocking is set in place and secure.
- B. Beginning of installation means acceptance of project conditions.

July 11, 2018

POPE'S TAVERN
ADDITION/RENOVATION
Halifax, Massachusetts

3.2 INSTALLATION

- A. Install access panels in accordance with manufacturer's instructions and direction from authorities having jurisdiction. Install miscellaneous specialties absolutely level and in true line, with units securely anchored to the surrounding construction.
- B. Test each door and latching device, and make adjustments required to ensure a bind-free operation and proper latching.

End of Section

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Section 08 31 23
BASEMENT BULKHEAD ACCESS DOORS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. The BIDDING REQUIREMENTS, CONTRACT FORMS, and CONTRACT CONDITIONS as listed in the Table of Contents, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. Furnish and install replacement exterior bulkhead basement access steel doors with sidewalls designed for flat concrete foundation installation.
 - 1. Provide extensions as may be required by field conditions.

1.3 RELATED REQUIREMENTS

- A. Section 03 30 00 - CAST-IN-PLACE CONCRETE

1.4 SUBMITTALS

- A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
 - 1. Product Data: Manufacturer's product data sheets, specifications and installation instructions.
 - 2. Shop drawings: Large scale details of basement bulkhead access doors, indicating all sizes, gages and thickness; provide complete installation details, coordinated to the specific receiving conditions.
 - 3. Verification samples: Paint finish.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Do not deliver access doors to the site, until all specified submittals have been submitted to, and approved by, the Architect.
- B. Store access door units inside, under cover, and in manner to keep them dry, protected from surface contamination, corrosion and damage from construction traffic and other causes.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design (Specified Manufacturer): To establish a standard of quality, design and function desired, Drawings and specifications have been based on Bilco Company, New Haven, CT., Product: " Classic Series

July 11, 2018

- B. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
 - 1. Bulkhead Doors, Inc., Middleborough MA.
 - 1. Bilco Company, New Haven, CT.
 - 2. The Gordon Corporation, Southington, CT.

2.2 BASEMENT BULKHEAD DOORS

- A. General: Description: Factory prefabricated steel door unit with integral curb having a clear opening matching existing.
 - 1. Features:
 - a. Single piece header.
 - b. Automatic hold open with safety catch.
 - c. Exterior keyed lock.
 - d. Hot-dipped galvanized sills.
 - e. Stainless Steel hinges
 - 2. Frame, sides and door: 12 gage (0.093 inch thick) galvanized steel.
 - 3. Hinge: Stainless steel hinge with stainless steel pin.
 - 4. Lock: Manufacturer's standard cylinder lock permitting locking from exterior.

2.3 FACTORY FINISHING

- A. Preparation;
 - 1. Clean surfaces by shot blasting. Blast using a media that will result in a target 1.5 – 2.5 mil surface profile. SSPC SP7 Brush Off Blast Cleaning Minimum.
 - 2. Grinding of Surface Defects. Any remaining surface defects after shot blasting should be ground and the immediate area air blasted.
 - 3. Apply finish coating manufacturer's recommended epoxy primer.
- B. Finish Coating: Shop-applied. Polyester Triglycidyl Isocyanurate (TGIC) coating powder coating epoxy coating complying with AAMA 2604, in smooth Semi-Gloss finish or approved equal.
 - 1. Minimum Film Thickness, Finish Coat: 2.5-3.5 mils, dry film thickness.
 - 2. Color: As selected by Architect from Manufacturer's standard colors

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Inspect all surfaces and verify that they are in proper condition to receive the work of this Section. Verify that prepared openings are ready to receive the work of this Section and opening dimensions are as indicated on the shop drawings. Verify that all blocking is set in place and secure.
- B. Beginning of installation means acceptance of project conditions.

July 11, 2018

POPE'S TAVERN
ADDITION/RENOVATION
Halifax, Massachusetts

3.2 INSTALLATION

- A. Install access panels in accordance with manufacturer's instructions and direction from authorities having jurisdiction. Install miscellaneous specialties absolutely level and in true line, with units securely anchored to the surrounding construction.
- B. Test each door and latching device, and make adjustments required to ensure a bind-free operation and proper latching.

End of Section

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Section 08 35 14
ACCORDION FOLDING DOORS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. The BIDDING REQUIREMENTS, CONTRACT FORMS, and CONTRACT CONDITIONS as listed in the Table of Contents, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. Furnish and install accordion folding doors.

1.3 RELATED REQUIREMENTS

- A. Section 02 41 19 - SELECTIVE DEMOLITION: Remove designated portions of partitions required to open or enlarge for new doors.
- B. Section 06 10 00 - ROUGH CARPENTRY: Wood blocking, and nailers; installation of steel door frames:.
- C. Section 08 71 00 – DOOR HARDWARE: Furnishing finish hardware, and installation templates for hardware cut-outs.
- D. Section 09 91 00 – PAINTING: Applied opaque finish coatings.

1.4 REFERENCES

- A. Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
 - 1. ASTM E336 - Standard Method of Measurement of Airborne Sound Insulation in Buildings.

1.5 SUBMITTALS

- A. Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
 - 1. Literature: Fabricator's product data sheets, specifications, performance data, physical properties for each item furnished hereunder.
 - 2. Certification: Fabricator's written certification stating that doors, meet or exceed the requirements specified under this Section; that specified shop finishing has been performed; and that all fire-resistive requirements for the indicated Labels have been met.
 - 3. Door schedule: A complete schedule of doors, to be furnished hereunder, coordinated with the schedule contained in the Contract Drawings.

July 11, 2018

4. Shop drawings: Elevations, and large scale sections and details of door and frame construction, indicating profiles, joinery and cut-outs for hardware and glazing .
5. Verification Samples:
 - a. For each specie of wood and finish scheduled for transparent finishes: submit two 12 inch long finished samples of each specie of wood specified, in the selected finishes.
 - b. After receipt of color selections from the Architect, submit 12 by 12 inch pieces of tempered hardboard, coated with the actual pigmented prefinishing system to be used, in each selected color.

1.6 DELIVERY, STORAGE AND HANDLING

- A. The Contractor is responsible to make certain that accordion doors are not delivered until the building and storage areas are sufficiently dry so that the doors will not be damaged by excessive changes in ambient humidity and relative moisture content.
- B. Inspect doors upon delivery for damage. Minor damage may be repaired provided the refinished items are equal in respects to new work and acceptable to the Architect; otherwise remove and replace damaged items.
- C. Store doors in protected, elevated, dry areas; protect from exposure to sunlight and moisture. Seal top and bottom edges if stored more than one week. Break packaging seal on-site to permit ventilation.

1.7 FIELD MEASUREMENTS

- A. Take field measurements before preparation of shop drawings and fabrication, where possible, to ensure proper fitting of Work.
- B. Allow for adjustments within specified tolerances wherever taking of field measurements before fabrication might delay Work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design: To establish a standard of quality, design and function desired, Drawings and specifications have been based on Woodfold Manufacturing Inc., Forest Grove Or: "Series 140".
- B. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
 1. Woodfold Manufacturing Inc., Forest Grove Or.
 2. Panelfold Inc., Miami FL.
 3. Accordion doors Inc., El Segundo CA.

July 11, 2018

2.2 COMPONENTS

- A. Track: 1-1/8 x 1 inch aluminum, pre-punched for screw fasteners for surface mounting.
- B. Roller assembly: Nylon wheels with Lexan axles; riveted to hinge, single trolley at alternate panels.
- C. Hinge assembly: 18 gage steel, continuous pin, riveted to top and bottom of door panel, with automatic stop at full extension.
- D. Panels: 1/4 inch thick medium density fiberboard with rabbeted edge for panel connector.
- E. Panel Connectors: Continuous non-rigid vinyl, inserted and glued into panel rabbet.
- F. Handle: Rigid molded polyvinyl chloride, full length of door, with molded finger pull front side.
- G. Latching: Magnetic catch, with strike plate.

2.3 FINISH

- A. Panels: Front face, hardwood veneer, wood species as selected by Architect, with sealer and clear lacquer topcoats on sight-exposed face; back face utility grade for painted coating.
- B. Aluminum: Manufacturer's standard clear anodized finish.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Inspect all surfaces and verify that they are in proper condition to receive the work of this Section.
- B. Beginning of installation means acceptance of existing project conditions.

3.2 INSTALLATION

- A. Perform installation of all items furnished hereunder, except as otherwise specified, in accordance with the approved shop drawings and the recommendations of the manufacturer.
- B. Set entire assembly including doors, track, and hardware, plumb and true to line, to assure smooth operation.

3.3 TOLERANCES

- A. Maintain dimensional tolerances and alignment with adjacent work. Maximum variation from plumb or level: 1/16 inch. Maximum variation in longitudinal or diagonal warp: 1/8 inch per 10 foot straight edge.

July 11, 2018

POPE'S TAVERN
ADDITION/RENOVATION
Halifax, Massachusetts

3.4 ADJUSTING

- A. Adjust door and grilles , hardware and operating assembly as required to ensure a smooth operation without binding.

3.5 CLEANING

- A. Daily clean work areas by sweeping and disposing of debris.
- B. Upon completion of the work of this Section in any given area, remove tools, equipment and all rubbish and debris from the work area; leave area in broom-clean condition.

End of Section

Section 08 54 00
COMPOSITE WINDOWS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. The BIDDING REQUIREMENTS, CONTRACT FORMS, and CONTRACT CONDITIONS as listed in the Table of Contents, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. Furnish and install shop fabricated, factory pre-finished wood fiber composite windows complete with hardware, factory glazing, weatherstripping, screens, sash ploughs, jamb extensions, and standard or specified anchorages, trim, attachments, and accessories. Work includes:
 - 1. Single hung windows.
 - 2. Awning windows.
 - 3. Casement windows.

1.3 RELATED SECTIONS

- A. Section 06 10 00 - ROUGH CARPENTRY: Framed openings, wood blocking and curbing.
- B. Section 06 20 00 - FINISH CARPENTRY: Providing interior finish trim around windows.
- C. Section 07 21 00 - THERMAL INSULATION: Perimeter vapor and air seal between window frame and adjacent construction.
- D. Section 07 92 00 - JOINT SEALANTS: Perimeter sealant and back-up materials.

1.4 ALTERNATES

- A. Refer to Section 01 23 00 - ALTERNATES, for Alternate Number 5 which affects the work of this Section.

1.5 REFERENCES

- A. Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
 - 1. ANSI/AAMA/NWDA 101/I.S.2/A440 – North American Fenestration Standard/Specification for Windows, Doors and Skylights. (NAFS).
 - 2. AAMA 502 - Voluntary Specification for Field Testing of Windows and Sliding Doors.

3. AAMA 613 - Voluntary Performance Requirements and Test Procedures for Organic Coatings on Plastic Profiles.
4. ANSI Z97.1 - Safety Performance Specifications and Methods of Test for Safety Glazing Used in Buildings.
5. ASTM C 1036 - Flat Glass.
6. ASTM C 1048 - Heat-Treated Flat Glass.
7. ASTM E 283 - Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors.
8. ASTM E 330 - Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.
9. ASTM E 331 - Test Method for Water Penetration of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.
10. ASTM E 405 - Wear Testing Rotary Operators for Windows.
11. ASTM E 546 - Test Method For Frost Point of Sealed Insulating Glass Units.
12. ASTM E 547 - Water Penetration of Exterior Windows, Curtain Walls, and Doors by Cyclic Static Air Pressure Difference.
13. ASTM E 576 - Test Method for Dew/Frost Point of Sealed Insulating Glass Units in Vertical Position.
14. ASTM E 773 - Test Method for Seal Durability of Sealed Insulating Glass Units.
15. ASTM E 774 - Sealed Insulating Glass Units.
16. Consumer Product Safety Commission: 16 CFR 1201 - Architectural Glazing Standards and Related Material.
17. FS RR-W-365A - Wire Fabric.
18. LSGA - Standards Manual.
19. Applicable recommendations and standards of the AA, SIGMA and the GANA)

B. Definitions:

1. NAFS: ANSI/AAMA/NWDA 101/I.S.2/A440-11 – North American Fenestration Standard/Specification for Windows, Doors and Skylights. (NAFS).

1.6 SUBMITTALS

A. Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:

1. Literature: Manufacturer's product data sheets, specifications, performance data, physical properties for each item furnished hereunder.
2. Certification: Fabricator's written certification stating that windows, meet or exceed the requirements specified under this Section; that specified shop finishing has been performed.
 - a. National Fenestration Rating Council (NFRC). Products shall be certified and labeled for U-Factor, Solar Heat Gain Coefficient (SHGC), and Visible Transmittance per NFRC 100 and 200 procedures.

- b. Window and Door Manufacturers Association (WDMA). Products shall be certified and labeled per WDMA Hallmark Certification Program to the NAFS, industry standard.
- c. Insulating Glass Units: Provide insulating glass units permanently marked with certification label of Insulating Glass Certification Council (IGCC) indicating compliance with ASTM E2190.
3. Manufacturer's sample warranties.
4. Schedule: A complete schedule of windows, to be furnished hereunder, coordinated with the schedule contained in the Contract Drawings, submitted for record only to Architect.
5. Shop drawings: 1/4 inch scale elevations, and large scale sections and details of window units, indicating profiles, joinery and cut-outs for hardware and glazing .
 - a. Window sections and details shall clearly show interfacing materials and surrounding conditions. Show all relationships and alignments with adjacent construction.
6. Verification samples:
 - a. 12 inch lengths of framing, and window sash having accepted finish in selected color.
 - b. Operating hardware (if requested).

1.7 QUALITY ASSURANCE

- A. Installer, with a minimum of 5 years documented experience demonstrating previously successful work of the type specified herein.
- B. Perform Work in accordance with NAFS.
- C. Insulating Glass Units: Provide insulating glass units permanently marked with certification label of Insulating Glass Manufacturers Alliance (IGMA) indicating compliance with ASTM E2190 and (IGMAC) indicating compliance with CGSB 12.8.
- D. Do not execute contract with window fabricator or place order for windows without receiving Architect's approval of full size physical samples of each type of unit to be furnished.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver window units in manufacturer's packaging undamaged, complete with installation instructions.
- B. Store all materials in an elevated dry location, protected by waterproof coverings. Protect exposed pre-finished surfaces without use of adhesive papers or sprayed coatings which may bond to surfaces.

1.9 FIELD MEASUREMENTS

- A. Wherever practicable, check dimensions of openings in the actual framing work, by accurate field measurement before fabrication. Show recorded measurements on shop drawings. Coordinate fabrication schedule with construction progress as

directed by the Contractor. When necessary to proceed with the fabrication without field measurements, coordinate and control installation tolerances to ensure proper fit of the work of this Section.

1.10 ENVIRONMENTAL CONDITIONS

- A. Install sealants under temperature and humidity conditions specified under Section 07 92 00 - JOINT SEALANTS and within range specified by sealant manufacturers.

1.11 WARRANTY

- A. Furnish the following warranties under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS:
1. Provide 20 year written warranty which shall include insulating glass against defects in materials and workmanship, including failure of seals and discoloration of Low E coating.
 - a. Warranty shall exclude glass breakage resulting from any cause.
 2. Provide a 10 year warranty which shall include repair or replacement of any (non-glass) window assembly or component which leaks, or exhibits defects in materials, finish, or function.
 - a. Warranty shall exclude glass breakage and exclude damage resulting from abuse or misuse.
 - b. Warranty shall include operating hardware.
 - c. Warranty shall include all labor and material costs to replace or repair defective window units, including cost of shipping of replacement units and components.
 3. Provide 5 year written warranty for color fading of exterior frame and sash.
 4. Provide a 2 year installer's warranty or bond which shall include repair or replacement of windows. Installer's standard form in which installer agrees to repair or replace composite windows that fail due to poor workmanship or faulty installation within the specified warranty period.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design: To establish a level of quality and visual characteristics desired, Drawings and specifications are based on Andersen Corporation, Bayport, MN., product "Andersen 100 Series".
- B. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
1. Andersen Corporation, Bayport, MN.
 2. Accurate Dorwin Company, Winnipeg, Manitoba, Canada.
 3. Duxton Windows and Doors, Winnipeg, Manitoba, Canada.
 4. Fibertec Window and Door Manufacturing Company, Concord, Ontario, Canada.
 5. Inline Fiberglass, Ltd., Toronto, Ontario, Canada.

2.2 PERFORMANCE

- A. Design, fabricate, assemble and erect windows, and their interfacing conditions with contiguous work, to ensure continuity of building enclosure vapor and air barriers and that all segments of the assemblies will be free from leakage under every condition of weather and exposure.
- B. Design and size members to withstand dead loads and live loads caused by pressure and suction of wind as calculated in accordance with the Massachusetts State Building Code, Ninth Edition to a design pressure/suction of not less than 20 psf as measured in accordance with ANSI/ASTM E 330.
- C. Provide tight joints and effectively seal component parts of windows, including their joints with contiguous work against water leakage and air infiltration. Water leakage is defined as the appearance of uncontrolled water.
- D. Performance requirements:
 - 1. Single hung windows:
 - a. General: Conform to NAFS requirements for minimum performance classification H LC-PG30, for air leakage, water drainage, water penetration, uniform structural loading, and further requirements of all of the following.
 - 1) Test unit size shall not be less than largest single hung window indicated on Drawings.
 - b. Air infiltration through assembly, tested in accordance with ASTM E283 with a static pressure difference of 1.57 psf.
 - 1) For operating sash, closed and locked, air infiltration shall not exceed 0.25 cfm per foot of sash crack length.
 - c. Water resistance: test in accordance with ASTM E547 at a static air pressure difference of 3.75 psf with result of no water leakage.
 - d. Uniform structural loading: test in accordance with ASTM E330 at a static air pressure difference of 37.5 psf (positive and negative) with result of no water leakage glass breakage, permanent damage to fasteners, hardware parts, support arms or actuating mechanisms, or other damage which would cause the window to be inoperable.
 - e. Thermal transmittance tests: Conform to NFRC 100 for a maximum conductive thermal transmittance "U-Value" of 0.30.
 - 2. Awning Windows:
 - a. General: Conform to NAFS requirements for minimum performance classification AP- LC-PG40, for air leakage, water drainage, water penetration, uniform structural loading , and further requirements of all of the following.
 - 1) Test unit size shall not be less than largest awning hung window indicated on Drawings.
 - b. Air infiltration through assembly, tested in accordance with ASTM E283 with a static pressure difference of 1.57 psf.
 - 1) For operating sash, closed and locked, air infiltration shall not exceed 0.05 cfm per foot of sash crack length.

July 11, 2018

- c. Water resistance: test in accordance with ASTM E547 at a static air pressure difference of 3.75 psf with result of no water leakage.
 - d. Uniform structural loading: test in accordance with ASTM E330 at a static air pressure difference of 37.5 psf (positive and negative) with result of no water leakage glass breakage, permanent damage to fasteners, hardware parts, support arms or actuating mechanisms, or other damage which would cause the window to be inoperable.
 - e. Thermal transmittance tests: Conform to NFRC 100 for a maximum conductive thermal transmittance "U-Value" of 0.30.
3. Casement Windows:
- a. General: Conform to NAFS requirements for minimum performance classification AP- LC-PG40, for air leakage, water drainage, water penetration, uniform structural loading and further requirements of all of the following.
 - 1) Test unit size shall not be less than largest awning hung window indicated on Drawings.
 - b. Air infiltration through assembly, tested in accordance with ASTM E283 with a static pressure difference of 1.57 psf.
 - 1) For operating sash, closed and locked, air infiltration shall not exceed 0.05 cfm per foot of sash crack length.
 - c. Water resistance: test in accordance with ASTM E547 at a static air pressure difference of 3.75 psf with result of no water leakage.
 - d. Uniform structural loading: test in accordance with ASTM E330 at a static air pressure difference of 37.5 psf (positive and negative) with result of no water leakage glass breakage, permanent damage to fasteners, hardware parts, support arms or actuating mechanisms, or other damage which would cause the window to be inoperable.
 - e. Thermal transmittance tests: Conform to NFRC 100 for a maximum conductive thermal transmittance "U-Value" of 0.30.
4. Sound transmission test (STC): 25 minimum for all window types.

2.3 MATERIALS

- A. Window Frame: Wood fiber and thermoplastic polymer composite profiles.
 - 1. Frame Depth: 3-1/4 inches.
- B. Sash Frame: Wood fiber and thermoplastic polymer composite profiles, 2-1/4 inches deep.
- C. Attachment Flange: 1-3/8 inches flange setback.

2.4 SINGLE HUNG WINDOWS

- A. Sash:
 - 1. Sash: Tilt-in design. Corners slot and tenoned and joined with two screws.
 - 2. Sash locks and keepers: Manufacturer's standard self latching sash locks in color selected by the Architect.
 - 3. Glazing gaskets: Manufacturer's standard.

July 11, 2018

- B. Hardware:
 - 1. Balancing System: Individually matched, Coil spring block and tackle system with nylon cord and fiber filled nylon clutch fitted with zinc die cast pins to engage and release the clutches permitting sash to be tilted in and removed.
 - 2. Lock: High pressure zinc die-cast cam lock and keeper. Finish: White. Provide two locks for windows greater than 36 inches width.
 - 3. Sash lift for lower sash: Formed sash lift.
 - 4. Jamb liners: Extruded PVC glide track for operating sash.
- C. Weatherstripping:
 - 1. Dual weather-stripped around perimeter with fin-type, dual-pile, weather stripping.

2.5 AWNING WINDOWS

- A. Hardware:
 - 1. Operator: Hardened steel operator arm stamped with a gear ring. Set arm gear between nylon bushing and nylon spacer. Encased drive shaft and worm gear assemblies in zinc die cast base and removable polycarbonate cover.
 - a. Exposed Fasteners: Stainless steel.
 - b. Operator Handle and Covers: Folding handle with powder coated painted finish and polycarbonate operator cover with integral color as selected by Architect.
 - 2. Hinges: Stainless steel and heavy gauge steel arms. Stainless steel reinforcing insert in low friction shoe for awning units
 - 3. Locking: Single handle locking, with positive active arms which reach out and pull sash into locked position. Provide two locks (unison operating) for windows greater than 27 inches width.
 - a. Lock Handle Finish: Polycarbonate in color selected by Architect.
- B. Weatherstripping:
 - 1. Sash: Flexible tubular vinyl, continuous on all 4 sides of sash.

2.6 CASEMENT WINDOWS

- A. Hardware:
 - 1. Operator: Hardened steel operator arm stamped with a gear ring. Set arm gear between nylon bushing and nylon spacer. Encased drive shaft and worm gear assemblies in zinc die cast base and removable polycarbonate cover.
 - a. Exposed Fasteners: Stainless steel.
 - b. Operator Handle and Covers: Folding handle with powder coated painted finish and polycarbonate operator cover with integral color as selected by Architect.
 - 2. Hinges: Stainless steel and heavy gauge steel arms. Stainless steel reinforcing insert in low friction shoe for awning units
 - 3. Locking: Single handle locking, with positive active arms which reach out and pull sash into locked position. Provide two locks (unison operating) for windows greater than 27 inches in height.

July 11, 2018

- a. Lock Handle Finish: Polycarbonate in color selected by Architect.

B. Weatherstripping:

- 1. Sash: Flexible tubular vinyl, continuous on all 4 sides of sash.

2.7 GLAZING

A. General: Glass shall conform to requirements specified above in the Article entitled "Performance Requirements".

- 1. Low-E Glass Argon Gas Blend Filled Insulating Glass Units:
 - a. Glass Type 1 (typical): Insulating glass units consisting of an outboard lite of clear annealed glass conforming to ASTM C1036, Type 1, Class 1, q3 and an inboard lite of clear annealed glass conforming to ASTM C1048, Type 1, Class 1, q3, Kind HS.
 - b. Glass Type 2 (Where safety glass is indicated or required by applicable code): Tempered insulating glass units consisting of an outboard and inboard lite of clear tempered glass conforming to ASTM C1048, Type 1, Class 1, q3, Kind FT.
 - c. Air Space: 9/16 inch (14.5 mm).
 - d. Filling: Fill space between glass lites with argon gas blend.
- 2. All windows shall be factory glazed with glazing sealant and snap-in rigid vinyl glazing bead.

2.8 INSECT SCREENS

A. Screens: Roll-formed, 0.024 inch (0.61 mm) aluminum frame with chromate conversion coating. Provide matching corner locks and latch retainers.

- 1. Type:
 - a. Awning and casement windows: Full size.
 - b. Double hung windows: Full size.
 - c. Single hung windows: Half size equal to sash height.
- 2. Screen Cloth: Vinyl-coated, 18/16 mesh, fiberglass screen cloth set in aluminum frame fitted to outside of window. Screen color Black/charcoal.
- 3. Frame Color: Match window exterior.

2.9 ACCESSORIES

A. Grilles: Provide contour profile aluminum muntin bars permanently mounted within insulating glass unit where indicated on Drawings equal to Andersen "Finelight™ Grilles".

- 1. Intersections: ABS concealed plastic connectors with nylon end keepers.
- 2. Exterior and Interior Surface: As selected by the Architect from the manufacturer's full range of available colors.
- 3. Width: 3/4 inch (19 mm).
- 4. Pattern: As indicated on Drawings.
- 5. Simulated Divided Lites (SDL): Provide manufacturer's standard aluminum grid between glass full depth of air space in black or aluminum finish with

applied exterior and interior muntins in sizes and profiles selected by the Architect refer to Section 01 23 00 - ALTERNATES.

- B. Jamb extensions: As indicated on Drawings.
 - 1. Contractor shall coordinate jamb extensions with wall construction and submit on shop drawings.
- C. Wood Non-Reinforced Joining: Machined LVL wood members treated with water repellent preservative after machining per WDMA I.S.4.
 - 1. Gusset Plates: Galvanized steel plates that attach to wood frame.
 - 2. Exterior Trim Strips: As recommended by window manufacturer for each joining method used.
 - 3. Color: Match window unit exterior color.
- D. Fasteners: Corrosion-resistant screws as provided by window manufacturer for fastening reinforcement members to wood frame and fastening end brackets to reinforcement members. Other fasteners provided by window installer.
- E. Sealant: As recommended by door manufacturer.
- F. Provide vinyl trim strips as recommended by window manufacturer for each joining method used.
 - 1. Color: Match window unit exterior color.
- G. Provide Head Flashing: Full-length aluminum drip cap.
 - 1. Color: Match window unit exterior color.
- H. Jamb clips: Galvanized steel.

2.10 FABRICATION

- A. Check dimensions of openings by accurate field measurement before fabrication.
- B. Fabricate windows allowing for minimum clearances and shim spacing around perimeter of assembly, yet enabling installation.
- C. Frames and sashes are mechanically assembled, joined and bonded with thermoset polyurethane adhesive, having mitered corners with integrated nylon gussets.
 - 1. Insulate frame cavities with expanded polystyrene insulation.
- D. Weatherstripping: Factory-applied to unit frame. Field-applied interlocking weatherstripping at panel meeting stiles.
- E. Fabricate with pre-determined weep or drain holes located on the sill.

2.11 FINISH:

- A. Fiberglass components, frame and sash (interior and exterior): Interior and exterior colors as selected by Architect from manufacturer's full range of colors available for specified window series.

July 11, 2018

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Inspect all surfaces and verify that they are in proper condition to receive the work of this Section.
- B. Beginning of installation means acceptance of existing conditions.

3.2 INSTALLATION

- A. Install windows in accordance with the manufacturers' installation instructions and industry standards. Ensure that all joints are completely weatherproof.
- B. Erect the windows plumb and level, free of warp or twist. Provide shims at bearing locations, anchors, and latch points, install in a manner so they are not dislodged by subsequent operations. Test sash and hardware operation and their alignment prior to permanently anchoring units in place.
- C. Maintain dimensional tolerances, aligning with adjacent work.
- D. Install anchors through frame and beside shims. Anchor window frame units to wood blocking with wood screws and to metal framing with toggle bolts; countersink anchor heads. All anchors shall be concealed by closed sash, or in the case of fixed units, with plugs.

3.3 TOLERANCES

- A. Maximum variation from level or plumb: 0.06 inches every 3 feet non-cumulative or 1/16 inch per 10 feet, whichever is less.

3.4 ADJUSTING

- A. Adjust operable sash and hardware for smooth operation and tight fit of sash. Lubricate hardware and other moving parts.

3.5 CLEANING

- A. Clean excess sealant or compound from glass and framing members immediately after application using solvents or cleaners recommended by the manufacturer.
- B. Clean glass surfaces promptly after installation, exercising care to avoid damage to the same.
- C. Wash down exposed surfaces free of dirt, handling marks, packing tapes, and foreign matter. Take care to remove dirt from corners. Wipe surfaces clean.

3.6 GLASS PROTECTION

- A. Protect glass from breakage immediately upon installation. Use streamers or ribbons suitably attached to framing and held free of the glass. Do not apply warning markings directly to the glass.
- B. Cover glass to protect it from activities that might abrade the glass surface.

July 11, 2018

POPE'S TAVERN
ADDITION/RENOVATION
Halifax, Massachusetts

- C. Prior to Date of Substantial Completion, the Contractor shall replace in kind and thickness all glass breakage, caused by the Work, weather, vandalism, accidents, negligence or any other reasons, with the costs being borne by the trade at fault, or the Contractor, as applicable.

End of Section

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Section 08 56 19
SERVICE WINDOWS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. The BIDDING REQUIREMENTS, CONTRACT FORMS, and CONTRACT CONDITIONS as listed in the Table of Contents, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. Furnish and install factory pre-assembled and fully glazed service window assemblies.
 - 1. Manual-operated factory pre-assembled and fully glazed service window assembly having horizontal sliding bi-passing lites, complete with installation hardware, operating hardware and mechanisms, and all related items.

1.3 RELATED REQUIREMENTS

- A. Section 07 92 00 - JOINT SEALANTS: Perimeter sealant and backup materials.
- B. Section 09 22 16 - NON-STRUCTURAL METAL FRAMING: Non-load bearing partition and ceiling framing and furring.
- C. Section 09 29 00 - GYPSUM BOARD: Gypsum board finishes.

1.4 REFERENCES

- A. Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES.
 - 1. ASTM B 209 - Aluminum and Aluminum-Alloy Sheet and Plate.
 - 2. ASTM B 221 - Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes.
 - 3. ASTM E 330 - Structural Performance of Exterior Windows, Curtain Walls and Doors by Uniform Static Air Pressure Difference.
 - 4. AAMA 611-12 – Voluntary Specification for Anodized Architectural Aluminum.
 - 5. AAMA 612-02 – Voluntary Specification, Performance Requirements, and Test Procedures for Combined Coatings of Anodic Oxide and Transparent Organic Coatings on Architectural Aluminum.

1.5 SUBMITTALS

- A. Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
 - 1. Literature: Manufacturer's product data sheets, specifications, performance data, and installation instructions.

July 11, 2018

2. Manufacturer's installation instructions. Indicate installation sequence and procedures, adjustment and alignment procedures.
3. Maintenance Data: Lubrication requirements and frequency, periodic adjustments required.
4. Warranty: Provide sample 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.
5. Shop drawings: Fully-dimensioned, large scale details of window construction and operating mechanisms, , and related items; with complete installation details reflecting actual site conditions for each location.
 - a. Indicate electrical requirements, connection details.
6. Selection samples: Sample card indicating Manufacturer's full range of finishes available for selection by Architect
7. Verification samples: 12 inch length samples of typical window frame illustrating material and finish.

1.6 QUALIFICATIONS

- A. Installer, with a minimum of 3 years documented experience demonstrating previously successful work of the type specified herein, and approved by product manufacturer.

1.7 DELIVERY STORAGE AND HANDLING

- A. Deliver window units in manufacturer's packaging undamaged, complete with installation instructions.
- B. Store all materials in an elevated dry location, protected by waterproof coverings. Protect exposed pre-finished surfaces without use of adhesive papers or sprayed coatings which may bond to surfaces.

1.8 FIELD MEASUREMENTS

- A. Check dimensions of openings by accurate field measurement before fabrication. Show recorded measurements on shop drawings. Coordinate fabrication schedule with construction progress as directed by the General Contractor.

1.9 WARRANTY

- A. Provide 1 year parts and labor warranty under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS. Warranty shall include materials and workmanship of pass windows satisfactory operation, and contain any limitations of items specified herein.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design: To establish a standard of quality, design and function desired, Drawings and specifications have been based on CR Laurence Company, Inc. Los Angeles CA.

July 11, 2018

2.2 HORIZONTAL SLIDING SERVICE WINDOWS

- A. Horizontal two panel sliding serving window with two sliding sections, equal to CR Laurence Company, Inc "Sharyn" Frameless series, configuration "XX", in custom size as shown on Drawings.

2.3 COMPONENTS

- A. Fabricate frame anodized aluminum extrusions conforming to ASTM B 221.
- B. Glazing: 1/4 inch thick tempered glass.
- C. Lock: Manual security locks; Inside mounted, pin tumble mechanism with adjustable keeper.

2.4 FACTORY FINISH

- A. Aluminum Finish coatings: Commercial anodic coatings conforming to AAMA 611-12, Class II, and performance criteria required in AAMA 612-02.
 - 1. Exposed Aluminum Surfaces: (AA designation M12C22A31) Architectural Class II anodic coating, 10 microns (0.4 mil thickness or greater), prepared with a mechanical M12, chemical C22 pre-treatment, and A31 Anodized Finish, clear in color.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Inspect and verify wall openings are in proper condition to receive the work of this Section. Verify that field measurements are as indicated on reviewed and approved shop drawings.

3.2 PREPARATION

- A. Prepare opening[s] to permit correct installation of door unit to perimeter air and vapor barrier seal.

3.3 INSTALLATION

- A. Perform installation of windows units, except as otherwise specified, in accordance with the approved shop drawings and the recommendations of the manufacturer.
- B. Anchor assembly to wall construction and building framing without distortion or stress.
- C. Brace door tracks suspended from structure. Secure tracks to structural members only.
- D. Set entire assembly including doors, guides, and hardware, plumb and true to line, to assure smooth operation.
- E. Coordinate installation of sealants and backing materials at frame perimeter of sectional overhead door as specified in Section 07 92 00 - JOINT SEALANTS.

July 11, 2018

3.4 TOLERANCES

- A. Maintain dimensional tolerances and alignment with adjacent work. Maximum variation from plumb or level: 1/16 inch. Maximum variation in longitudinal or diagonal warp: 1/8 inch per 10 foot straight edge.

3.5 ADJUSTING

- A. Adjust pass doors, hardware and operating assembly as required to ensure a smooth operation without binding.

3.6 CLEANING

- A. Remove all labels, protective films and coverings from assembly components.
- B. Clean window unit, pass doors, frame and glass.
- C. Remove tools, equipment and all rubbish and debris from the work area, caused by the work of this Section; leave area in broom-clean condition.

End of Section

Section 08 62 00
UNIT SKYLIGHTS
(FILED SUB-BID REQUIRED AS PART OF SECTION 07 00 02)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Sub-Bid Requirements: As provided under Section 07 00 02 – ROOFING AND FLASHING FILED SUB-BID REQUIREMENTS and supplemented under the Bidding Requirements, Contract Forms, and Conditions of the Contract, and applicable parts of Division 1 - GENERAL REQUIREMENTS.
 - 1. Work of this Filed Sub-Bid includes all individual specification sections listed in Section 07 00 02.

1.2 SUMMARY

- A. The work of this Section consists of unit skylights, where shown on the Drawings, as specified herein, and as required for a complete and proper installation. Work includes, but is not limited to the following scope.
- B. Furnish and install plastic domed unit skylights.

1.3 RELATED REQUIREMENTS

- A. Section 06 10 00 - ROUGH CARPENTRY: Wood framing, curb and blocking.
- B. Section 07 21 00 - THERMAL INSULATION: Thermal batt, blanket and rigid insulation, vapor barrier materials and foamed-in-place insulation.
- C. Section 07 31 13 – ASPHALT SHINGLES.
- D. Section 07 92 00 - JOINT SEALANTS: Requirements for Sealants.

1.4 REFERENCES

- A. Referenced Standards: Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. The standards referenced herein are included to establish recognized minimum quality only. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern. Equivalent quality and testing standards will be acceptable, subject to their timely submission, review and acceptance by the Architect.
 - 1. AAMA 607.1 - Specifications and Inspection Methods for Clear Anodic Finishes for Architectural Aluminum.
 - 2. ANSI Z 97.1 - Performance Specifications and Methods of Test for Safety Glazing Material Used in Buildings.
 - 3. ASTM B 209 - Aluminum and Aluminum-Alloy sheet and Plate.
 - 4. ASTM B 221 - Aluminum and Aluminum-Alloy Extruded Bar, Rod, Wire, Shape, and Tube.
 - 5. All applicable federal, state and municipal codes, laws and regulations for skylights and fall-safety.

1.5 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. General: Coordinate the work of this Section with the respective trades responsible for installing inserts and anchorages furnished by this Section; make arrangements for delivery, receipt and installation of inserts and anchorages to prevent delay of the Work.
 - 2. Coordinate the work with the installation of wood curbs and roofing system.
 - 3. Coordinate this section with dimensions, tolerances, and method of attachment with other adjacent work.
- B. Pre-installation Meetings: Installer of the Work of this Section is required to attend pre-installation conference specified under Section 07 54 19 – POLYVINYL CHLORIDE (PVC) ROOFING.
- C. Sequencing:
 - 1. Field Measurements: Verify that field measurements are as indicated on shop drawings.

1.6 SUBMITTALS

- A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
 - 1. Product Data: Manufacturer's product data sheets, specifications, and performance data.
 - 2. Shop Drawings: Include large scale design details showing attachment and flashing details; and complete installation details.
 - 3. Manufacturer's Instructions: Indicate installation procedures, and perimeter conditions requiring special attention.
- B. Closeout Submittals: Submit the following under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS.
 - 1. Bonds and Warranty Documentation:
 - a. Manufacturer's Warranties and Guarantees as specified elsewhere herein this Section.

1.7 QUALITY ASSURANCE

- A. General:
 - 1. Notify the Architect where conflicts apply between referenced standards and existing materials, and existing methods of construction.
 - 2. Design, fabricate, assemble and erect the skylights, and their interfacing conditions with contiguous work, to ensure that all segments of the skylight assemblies will be free from leakage.
- B. Qualifications:
 - 1. Installer/Applicator: Minimum of 3 years documented experience demonstrating previously successful work of the type specified herein.

2. Professional Engineer Qualifications: Design structural elements under direct supervision of Professional Engineer experienced in design of this Work and licensed in the Commonwealth of Massachusetts

1.8 DELIVERY, STORAGE AND HANDLING

- A. Delivery and Acceptance Requirements:
 1. Do not deliver items to the site, until all specified submittals have been submitted to, and approved by, the Architect.
 2. Deliver materials in a timely manner to maintain continuous erection.
 3. Provide wrapping to protect acrylic and aluminum surfaces. Do not use adhesive papers which bond when exposed to sunlight or weather.
- B. Storage and Handling Requirements:
 1. Protect materials from damage due to moisture, direct sunlight, excessive temperatures, surface contamination, corrosion and damage from construction operations and other causes.

1.9 WARRANTY

- A. General: Submit warranties under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS.
- B. Manufacturer Warranty:
 1. In addition to the specific guarantee requirements of the GENERAL CONDITIONS and SUPPLEMENTAL GENERAL CONDITIONS, the Contractor shall obtain in the Owner's name the standard written manufacturer's guarantee of all materials furnished under this Section where such guarantees are offered in the manufacturer's published product data. All these guarantees shall be in addition to, and not in lieu of, other liabilities which the Contractor may have by law or other provisions of the Contract Documents.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design (Specified Manufacturer): To establish a standard of quality, design and function desired, Drawings and specifications have been based on Velux-America Inc., Wilmington MA., Commercial Skylights.
- B. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
 1. Velux-America Inc., Wilmington MA.
 2. American Skylights, Arlington, TX.
 3. Artistic Skylight Domes Ltd., Ontario Canada.
 4. Bristolite Skylights, Santa Ana, CA.
 5. Sunoptics Prismatic Skylights, Sacramento, CA.
 6. Wasco Products, Inc., Sanford ME.

July 11, 2018

2.2 DESCRIPTION

- A. General Description: Factory prefabricated acrylic dome type units, sized as indicated on Drawings.
- B. Regulatory Requirements
 - 1. Obtain certificate of compliance from authority having jurisdiction indicating approval of specified products.

2.3 PERFORMANCE/DESIGN CRITERIA

- A. Engineering criteria: The manufacturer for automatic entrances shall employ the services of a qualified structural engineer, registered to practice in the Commonwealth of Massachusetts, to prepare all calculations and other performance criteria for the respective systems, and bear all costs therefor. All shop drawings for the metal components of the respective systems shall bear the registration stamp of the engineer.
- B. Performance Requirements
 - 1. Wind Loading: Panels and installation shall be designed to conform to Massachusetts State Building Code, Ninth Edition, (780 CMR 1609) for basic wind speed of 134 miles per hour (3 second gust), Risk Category II.
 - 2. Snow Loading: 30 pounds per square foot.
- C. Fall Safety Performance Criteria: Loading, minimum 30 pounds per square foot tributary roof load, or greater as required by building code
 - 1. Test Standard: Test and label in accordance to AAMAWDMACSA1011.S.2A440.
 - 2. Drop Test:
 - a. A 200 lb (91 kg) drop test from a height of 24 inches (610mm) above the center (highest point) of dome shape and at mid points of both the 5 foot (1524mm) and 6 foot (1829mm) side (approximately 15 inches (381mm) and 18 inches (457mm) from center).
 - b. The 200 lb (91 kg) load must be contained within a flexible bladder or sack having approximate dimensions no larger than 30 inches long, 20 inches wide, and 8 inches high (762mm x 508mm x 203mm), filled with course sand or pea gravel.
 - c. The dome must withstand the sack drop without inverting or breaking.
 - d. Finished skylight domes sealed in frame must also handle 500 lb (227 kg) on 1 square foot (.09 sm) point loading without inverting.
 - e. The drop test must be witnessed and certified by the test laboratory which provides the NAFS certification.
- D. Energy Performance: Glazing material must have a maximum light distribution characteristic that maximizes the shading factor. Per Addendum D of ASHRAE 90.1 - 2007, the diffusing qualities of glazing must have a minimum haze factor of 90 percent or greater. The combined inner/outer lens target values shall be as follows:
 - 1. Light Transmittance: 67.8 percent minimum. CLASS 1 & CLASS 3 ACRYLIC

July 11, 2018

2. Light Transmittance: 60.0 percent minimum. White Armor Polycarbonate (Lexan SLX)
3. Diffusion / Haze Factor: 100 percent min.
4. Solar Heat Gain Coefficient (SHGC): 0.40 maximum. NFRC 200
5. "U" Value: 0.50 or lower (glazing and framing) in accordance with NFRC 100 or "unlabeled skylight" default requirements of ASHRAE 90.1 - 2007.

2.4 MANUFACTURED UNITS

- A. Factory prefabricated, complying with the following:
 1. Curb construction: 040 inch thick aluminum liner; minimum 0.078 inch thick aluminum curb of height to match existing, provided with integral cap flashing and 3 inch metal mounting flange.
 2. Top construction: Minimum 0.062 inch thick aluminum framed cover, and glazing as specified.
 3. Double thickness pyramid clear acrylic plastic glazing with exterior layer "clear" tinted and interior dome "white".
 4. Gaskets: Extruded neoprene glazing gaskets, and isbutylene/isoprene between domes, sealed with no weeps.
- B. Fabricate components free of visual distortion or defects. Weld corners and joints. Provide for removal of condensation occurring within components of assembly. Fit components for weathertight assembly.
- C. Fabricate components free of visual distortion or defects. Weld corners and joints. Provide for removal of condensation occurring within components of assembly. Fit components for weathertight assembly.

2.5 FALL PROTECTION SCREENING

- A. Description: Skylight glazing that does not comply with code mandated Fall Safety Performance Criteria shall require a metal screen system that is attached to the outer frame of curb-mounted unit skylights.
 1. Performance Criteria: Comply with OSHA General Industry Standard 29 CFR 1910.23 (a)(4) and 29 CFR 1910.23 (e)(8).
- B. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
 1. Better Wire Products, Buffalo NY.
 2. Flexible Lifeline Systems, Houston TX.
 3. Kee Safety In., Buffalo NY.
 4. Plasteco, Inc., Houston TX.
 5. Safety Rail Source, Norristown, PA.
- C. Components:
 1. Mounting Frame: Two extruded 6005-T6 aluminum rails that rest on the outside frame of the skylight on its long sides. Frame is connected on the short side of skylight without penetration of skylight frame components.

July 11, 2018

2. Screen Material: 0.187 and 0.250 diameter type 304 stainless steel wire in a 4 by 4 inch square grid.
 - a. Screen Installation: Screens are positioned in the channel of the aluminum frame and then locked into place with aluminum clips attached to the frame using stainless steel hex head screws.
3. Installation hardware: Stainless steel.

2.6 ACCESSORIES

- A. Sealant and backing materials: As specified in Section 07 92 00 - Joint Sealants of types described below.
 1. Perimeter sealant: Sealant type P2.
- B. Protective back coating: FS TT-C-494, bituminous. Apply one coat of bituminous coating to concealed aluminum surfaces in contact with dissimilar materials for the prevention of electrolytic action and corrosion. Do not use bituminous mastic where it might contaminate a joint or surface to receive sealant
- C. Fasteners: Type 302/304 stainless steel.
- D. Flashings: 0.078 inch thick, same metal type and finish as skylight frame. secured with concealed fastening method.
- E. Anchorage devices: Type recommended by manufacturer, concealed.

2.7 FABRICATION

- A. General: Do not fabricate materials until all specified submittals have been submitted to, and approved by, the Architect.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verification of Conditions: Inspect all surfaces and verify that they are in proper condition to receive the work of this Section.
 1. Beginning of installation means acceptance of existing substrate and project conditions.

3.2 INSTALLATION

- A. Install skylight in accordance with manufacturer's instructions.
- B. Method of attachment to structure to permit sufficient adjustment to accommodate construction tolerances and irregularities.
- C. Align assembly free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.
- D. Attach and seal to adjacent air and vapor barrier materials.
- E. Pack fibrous insulation in shim spaces at perimeter of assembly to ensure continuity of thermal barrier.

- F. Install perimeter sealant and backing materials in accordance with Section 07 92 00 - JOINT SEALANTS.
- G. Provide alignment attachments, shims, and anchors required to permanently fasten skylights to building structure.

3.3 TOLERANCES

- A. Maximum variation from plumb or level: 1/4 inch.
- B. Maximum offset from true dimensional alignment: 1/4 inch.

3.4 CLEANING

- A. Upon completion of the work of this Section in any given area, remove tools, equipment and all rubbish and debris from the work area; leave area in broom-clean condition.
- B. Clean work under provisions of Section 01 70 00 – EXECUTION.
 - 1. Clean and polish all acrylic surfaces, inside and out.

3.5 PROTECTION

- A. Protect finished work under provisions of Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS.

End of Section

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Section 08 80 00
GLAZING

PART 1 – GENERAL

1.1 SUMMARY

- A. The work of this Section consists of glass and glazing work where shown on the Drawings, as specified herein, and as required for a complete and proper installation. Work includes, but is not limited to the following scope.
- B. General requirements and definition of glass types for glazing work specified under other individual specifications.
- C. Furnish and install the following:
 - 1. Tempered glass in non-rated wood and hollow metal doors and frames.
 - 2. Wire-less fire resistant rated glazing in designated rated doors and frames.
 - 3. All materials required to properly install glass furnished hereunder, including sealant, tapes, setting blocks, and spacers.
- D. Work of this section includes installation of glazing beads furnished under related sections.

1.2 RELATED REQUIREMENTS

- A. Section 06 10 00 - ROUGH CARPENTRY: Installation of steel door frames.
- B. Section 06 20 00 - FINISH CARPENTRY: Installation of doors.
- C. Section 07 92 00 - JOINT SEALANTS: Requirements for sealants and backing materials.
- D. Section 08 11 13 - HOLLOW METAL DOORS AND FRAMES: Steel doors, door and window frames, and related glazing stops, for both fire-resistance rated (labeled) and non-rated (labeled) conditions.
- E. Section 08 62 00 - UNIT SKYLIGHTS: Plastic glazed (pre-glazed) modular skylights.
- F. Section 08 63 00 - METAL-FRAMED SKYLIGHTS: Engineered glazed skylights.
- G. Section 10 28 13 - TOILET ACCESSORIES: Framed mirrors.

1.3 REFERENCES

- A. Referenced Standards: Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. The standards referenced herein are included to establish recognized minimum quality only. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern. Equivalent quality and testing standards will be acceptable, subject to their timely submission, review and acceptance by the Architect.
 - 1. AAMA 804.1 - Ductile Back-Bedding Compound.
 - 2. ASTM C 1036 - Flat Glass.

July 11, 2018

3. ASTM C 1048 - Heat-Treated Flat Glass - Kind HS, Kind FT Coated and Uncoated Glass.
 4. ANSI Z97.1 - Safety Performance Specifications and Methods of Test for Safety Glazing Used in Buildings.
 5. Federal Safety Standards for Architectural Glazing Materials 16CFR1201.
 6. FS TT-S-001543A - Sealing Compound, Silicone Rubber Base.
 7. NFPA Publication 80 - Fire Doors and Windows.
 8. SGCC: Certified Products Directory, and Certification Guidelines.
- B. Inclusionary References: The following reference materials are hereby made a part of this Section by reference thereto:
1. GANA - Glazing Manual (50th Anniversary edition).
 2. Consumer Product Safety Commission (CPSC) 16CFR 1201 Code of Federal Regulations for Architectural Glazing Materials.

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
1. General: Coordinate the work of this Section with the respective trades responsible for installing interfacing and adjoining work for proper sequence of installation, and ensure that the work performed hereunder is acceptable to such trades for the installation of their work.
- B. Sequencing:
1. Field Measurements
 - a. Take field measurements before preparation of shop drawings and fabrication, where possible, to ensure proper fitting of Work.
 - b. Allow for adjustments within specified tolerances wherever taking of field measurements before fabrication might delay Work.

1.5 SUBMITTALS

- A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
1. Product Data:
 - a. Product data sheets on glazing products: Provide chemical, functional, and environmental characteristics, size limitations, special application requirements. Identify available colors.
 - b. Sample 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.
 2. Shop Drawings: Show sufficient detail to show fabrication, installation, anchorage, and interface of the work of this Section with the work of adjacent trades.
 - a. Plans and elevations 1/4 inch scale of each type of glazing assembly, and mirror assembly; indicate dimensions, and reference details. Verify dimensions with field measurements.

- b. Large scale design details of glazing conditions; indicating sizes, types, and gauges of all metal components; glazing details, indicating types and thickness of glass; bracing and stabilizing members; attachment clips and brackets; and complete installation details.
 - 3. Verification Samples:
 - a. 12 x 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. Certificates: Manufacturer's written certification stating that the materials installed, meet or exceed the requirements specified under this Section.
 - 5. Source Quality Control Submittals:
- B. Closeout Submittals: Submit the following under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS.
 - 1. Bonds and Warranty Documentation:
 - a. Manufacturer's Warranties and Guarantees as specified elsewhere herein this Section.

1.6 QUALITY ASSURANCE

- A. General: Perform glazing work in accordance with GANA Glazing Manual, SIGMA and LSGA standards for glazing and installations methods.
 - 1. Notify the Architect where conflicts apply between referenced standards and existing materials, and existing methods of construction.
- B. Glass Labeling:
 - 1. General: Manufacturer's Label shall be, acid-etched, sandblasted, ceramic-fired, laser-etched, embossed, or other similar type which, once applied, cannot be removed without being destroyed.
 - 2. Safety glass: Label tempered and laminated safety glass with permanent manufacturer's label on each light with the mark visible after installation.
 - a. Furnish SGCC certification for safety glass in compliance with CPSC 16 CFR 1201 Cat 1 or Cat 11, or ANSI Z-97.1.
 - 3. Fire-rated glass: Label each individual glazing unit with appropriate UL, Warnock Hersey, or other approval labeled markings with the listing mark visible after installation.
- C. Qualifications:
 - 1. Fabricators: Glazier specializing in applying the work of this Section with a minimum of 5 years experience.
 - 2. Installer/Applicator: Minimum of 3 years documented experience demonstrating previously successful work of the type specified herein.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Delivery and Acceptance Requirements:
 - 1. Do not deliver items to the site, until all specified submittals have been submitted to, and approved by, the Architect.

2. Deliver materials in labeled, protective packages, when and as required.
- B. Storage and Handling Requirements:
1. Store and handle in strict compliance with manufacturer's instructions and recommendations of GANA Glazing Manual. Use clean gloves and tools when handling materials, avoid contamination. Use rolling blocks and suction cups to move glass units not in shipping crates.
 - a. Carefully store materials to avoid overloading any building component or structure.
 - b. Do not unpack material until it is to be set, unless un-packing is required for inspection by the Architect.
 2. Store mirrors and coated glass in a dry place with acid-free paper between glass sheets.
 3. Protect factory finished materials from damage due to moisture, direct sunlight, excessive temperatures, surface contamination, corrosion and damage from construction operations and other causes.
- 1.8 SITE CONDITIONS
- A. Do not install glazing when ambient temperature is less than 50 degrees Fahrenheit.
 - B. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.
- 1.9 WARRANTY
- A. General: Submit warranties under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS.
 - B. Manufacturer Warranty/Guarantee: All shall include replacement of defective glass and mirrors, and delivery of replacement glass products furnished f.o.b. from point of manufacturer to project site.

PART 2 - PRODUCTS

2.1 GLASS - GENERAL

- A. General requirements for glass: Of domestic and foreign 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.
 1. 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.
- B. Float Glass: Comply with ASTM C 1036, Class 1 clear, quality q3 glazing select.
- C. Heat Strengthened Glass: Comply with ASTM C 1048 HS, heat strengthened, Class 1 clear, quality q3 glazing select.

July 11, 2018

- D. Tempered Glass: Comply with ASTM C 1048 FT, fully tempered, Class 1 clear, quality q3 glazing select, conforming to ANSI Z97.1.

2.2 GLASS – TYPES

- A. Glass Type 1 - Tempered Safety Glass, clear: 1/4 inch thick.
- B. Glass Type 2: 5/16 inch transparent wire-less fire rated ceramic glazing material with polished finish: Technical Glass Products., "Firelite Plus".
 - 1. For fire rated door assemblies, conform with latest edition of ASTM E152, ASTM E163, NFPA-80, NFPA 252, NFPA 257.
 - 2. Conforms to ANSI Z97.1 - Safety Performance Specifications and Methods of Test for Safety Glazing Used in Buildings.
 - 3. Permanently identify each individual glazing unit with a listing mark visible after installation.
 - 4. In accordance with manufacturer's specifications, Firelite Plus must be glazed into frames with a similar rating, using silicone glazing compound which shall be supplied with the Firelite Plus material.

2.3 FABRICATION

- A. General: Do not fabricate materials until all specified submittals have been submitted to, and approved by, the Architect.
- 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 heat-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.
- C. Fabricate glass with the following edge treatments.
 - 1. Exposed edges: Polished-finished radiused (penciled).
 - 2. Concealed edges: Cut edges with minimum edge work.
 - 3. Butt-joint edges: Flat round and finished with edges eased.
- D. Shop Fabrication:
 - 1. All vision panels and baffles shall be cut to size by manufacturer or by fabricator prior to delivery to site. All glass edges shall be ground smooth, polished and eased. Provide all necessary holes wherever required by the approved Shop Drawings, drilled and tapped to suite project requirements. Do all cutting and drilling prior to tempering.

2.4 ACCESSORIES

- A. Glazing tape: Preformed butyl-polyisobutylene rubber with 100 percent solids contained in extruded tape roll form and complying with AAMA 804.1; coiled on release paper; of sizes required for proper glazing. equal to one of the following:
 - 1. Protective treatments 3030 or 606.
 - 2. Tremco Preshimmed 440.

July 11, 2018

3. Woodmont Chem-Tape 40.
- B. Setting blocks: Neoprene, 80-90 shore A durometer hardness, certified to be "silicone compatible"; sized as follows:
 1. Length: 0.1 inch per square foot of glass, but not less than 4 inches.
 2. Width: equal to glazing rabbet space minus 1/16 inch.
 3. Height to suit glazing method and pane weight and area.
- C. Spacers: Neoprene, 60-80 shore A durometer hardness; sized as required.
- D. Glazing sealant:
 1. General glazing sealant: One-part medium modulus, neutral curing, synthetic rubber sealant, having a useful life expectancy of at least 20 years, conforming to ASTM C 920, Type S, grade NS, Class 25 for uses NT, G and A, FS TT-S-001543A, Type, Class A. Color as selected by Architect.
 - a. Dow Corning Corporation, Midland MI.; product, "Silicone Glazing Sealant".
 - b. General Electric Company (GE Silicones) Waterford NY.; product, "SilGlaze II SCS2800".
 - c. Tremco, Beachwood OH.; product, "Proglaze.
- E. Bond-breakers and backing materials: Type recommended by manufacturer of sealants and gaskets.
- F. Cleaners, Primers, and Sealers: Type recommended by manufacturer of glass and gaskets.

2.5 ACCESSORIES FOR WIRE-LESS FIRE-RATED GLAZING

- A. Glazing Tape: Closed cell polyvinyl chloride (PVC) foam, coiled on release paper over adhesive on two sides, maximum water absorption by volume of 2.5 percent.
- B. Silicone Sealant: One-part neutral curing silicone, medium modulus sealant, Type S; Grade NS; Class 25 with additional movement capability of 50 percent in both extension and compression (total 100 percent); Use (Exposure) NT; Uses (Substrates) G, A, and O as applicable. Available Products:
 1. Dow Corning Corporation, Midland MI.; product, "795".
 2. General Electric Company (GE Silicones) Waterford NY.; product "Silglaze-II 2800"
 3. Tremco, Beachwood OH.; product, "Spectrem 2".
- C. Setting Blocks: Neoprene, EPDM, or silicone; tested for compatibility with glazing compound; of 70 to 90 Shore A hardness.

PART 3 - EXECUTION

3.1 EXAMINATION AND PREPARATION

- A. Inspect receiving surfaces and ensure that they 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. Field Measurements: Verify that field measurements are as indicated on approved Shop Drawings.
 - 1. 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.
 - 2. 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.
- C. Beginning of installation means acceptance of existing conditions.

3.2 GENERAL INSTALLATION OF GLASS HAVING PERMANENT LABELS

- A. Install glass units so that appropriate manufacturer's permanent label for safety glass, and permanent label for fire-rated glass are visible.

3.3 INSTALLATION - DRY GLAZING

- A. Utilize dry glazing methods for field installation of glass in interior doors and frames.
 - 1. Install in vision panels in fire-rated doors and frames to requirements of NFPA 80.
- B. Cut glazing tape to length and set against permanent stops, projecting 1/16 inch (2 mm) above sight line.
- C. Place setting blocks at 1/4 points with edge block no more than 6 inches from corners.
- D. Rest glazing on setting blocks and push against tape for full contact at perimeter of pane.
- E. Place glazing tape on free perimeter of glazing in manner as described above.
- F. Install removable stop without displacement of tape. Exert pressure on tape for full continuous contact.
- G. Knife trim protruding tape.

3.4 PROTECTION

- A. Protect glass from breakage immediately upon installation. Use streamers or ribbons suitably attached to framing and held free of the glass. Do not apply warning markings directly to the glass.
- B. Cover glass To protect it from activities that might abrade the glass surface.

July 11, 2018

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3.5 CLEANING

- A. Clean glass surfaces promptly after installation, exercising care to avoid damage to the same. Remove excess glazing tape, labels, dirt, and other contaminants.

End of Section

Section 08 90 00
LOUVERS AND VENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish and install the following:

1.2 RELATED REQUIREMENTS

- A. Section 07 92 00 - JOINT SEALANTS: Providing perimeter sealant and backing materials.
- B. Division 23 - HEATING, VENTILATING AND AIR CONDITIONING:
1. Blank-off plates on back side of louvers.

1.3 REFERENCES

- A. Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
1. AAMA 2605 - Specification for High Performance Organic Coatings on Architectural Extrusions and Panels.
 2. ASCA 96 - Voluntary Specification for Performance of Organic Coatings on Architectural Aluminum Curtainwall, Extrusions and Miscellaneous Aluminum Components.
 3. ASTM B 209 - Aluminum-Alloy Sheet and Plate.
 4. ASTM B 221 - Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes.
- B. Inclusionary References: The following reference materials are hereby made a part of this Section by reference thereto:
1. ANSI/AMCA Standard 500-L - Laboratory Methods of Testing Louvers for Rating.
 2. ANSI/AMCA Publication 501 - Application Manual for Air Louvers.
 3. ANSI/AMCA Publication 511 - Certified Ratings Program Product Rating Manual for Air Control Devices..

1.4 SUBMITTALS

- A. Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
1. Literature: Manufacturer's product data sheets, specifications, performance data, physical properties for each type of louver and related components furnished hereunder.
 2. Manufacturer's sample warranties for louvers and finishes.

July 11, 2018

3. Schedule: Schedule of all louvers to be furnished hereunder, indicating locations for each size and type of louver, and locations and sizes of blank off panels
4. Shop drawings:
 - a. Large scale details of louver and blank off panel construction, indicating all sizes, gages, and thickness; large scale details of bird screens and accessory items; and complete installation details, coordinated to the specific receiving conditions. All details bearing dimensions of actual measurements taken at the project.
5. Samples:
 - a. Sample card indicating Manufacturer's full range of colors available for selection by Architect.
 - b. 12 inch long finish samples of louver frame showing each type material finish and color selected.

1.5 QUALITY ASSURANCE

- A. Perform work in accordance with AMCA Certification for louvers. Mark units with AMCA Certified Ratings Seal.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Store all materials in an elevated dry location, protected by waterproof coverings

1.7 WARRANTY

- A. General: Submit the following warranties under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS, and in compliance with Section 01 78 36 – WARRANTIES.
 1. Louver manufacturer's standard warranty.
 2. Finish Warranty: 10 year warranty on louver finish which shall include covering the applied finish against defects, including color fading, chipping, crazing, pitting, and delamination.

PART 2 - PRODUCTS

- A. Basis of Design (Specified Manufacturer): To establish a standard of quality, design and function desired, Drawings and specifications have been based on Airlite Company, Schofield WI.
- B. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
 1. Airlite Company, Schofield WI.
 2. Construction Specialties, Inc., Cranford NJ.
 3. Industrial Louvers, Inc., Delano MN.
 4. Greenheck Fan Corporation, Schofield, WI.
 5. Ruskin Louvers, Inc., Cincinnati OH.
 6. Cesco Products, Minneapolis MN.

July 11, 2018

2.2 ARCHITECTURAL LOUVERS

- A. Architectural Louvers: Nominal 4 inch deep architectural louvers in the arrangements and dimensions shown on the Drawings. Louvers shall be stationary, horizontal fixed louvers. Airlite Model K609, or approved equal in compliance with specified requirements.
1. Nominal Louver depth: 4 inches (101.6 mm).
 2. Shape: Round as indicated on Drawings.
 3. Framing: Heads, sills, jambs and mullions to be one piece structural members of 6063-T5 alloy minimum 0.081 inch (2.06 mm) thick.
 4. Blades: 45 degree continuous design, minimum 0.081 inch (2.06 mm) thick with back lip.
 - a. Fabricate louver with close-fitting, field made splice joints in blades designed to permit expansion and contraction without deforming blades or framework and with mullions recessed from front edges of blades so blades have continuous appearance.
 5. Screen: 1/2 inch mesh by 0.063 inch (1.6 mm) diameter bird screen secured within a extruded aluminum frame.
 6. Performance criteria:
 - a. Minimum Free Area: 49.0 percent (As determined in accordance with AMCA Standard 500, and certified by AMCA Standard 511), 7.91 square feet free area per 4'-0" by 4'-0" sized unit.
 - b. Free Area Velocity at beginning point of water penetration: 1106 FPM.
 - 1) Water penetration shall not exceed 0.01 ounces of water per square foot of free area at a velocity of 1106 FPM when tested per AMCA Standard 500.
 - c. Air volume delivered at beginning point of water penetration: 9342 CFM.
 - d. Pressure Drop at beginning point of water penetration: 0.08 inches water.
 - e. Design louver to sustain a wind load of not less than 25 pounds per square foot.
- B. Provide permanent and removable louver units or panels, as indicated on Drawings or as otherwise required by mechanical systems.

2.3 ACCESSORIES

- A. Fasteners and Anchors: Stainless steel type.
- B. Fasteners and Anchors: Galvanized type.
- C. Primer: Zinc chromate, alkyd type.
- D. Flashings: Of same material as louver frame.
- E. Sealant: Joint Sealer Type P2 as specified under Section 07 92 00 - JOINT SEALANTS.

July 11, 2018

2.4 FACTORY FINISHING

- A. Shop-applied Polyvinylidene Fluoride (PVDF) resin based, high performance thermoplastic organic coating conforming to AAMA 2605, NAAMM - Metal Finishes Manual, and the following:
 - 1. Resin base of 70 percent PVDF by weight, Atochem North America, Inc., product "Kynar 500" or Ausimont USA. product "Hylar 5000".
 - 2. Finish Coating shall be manufactured as one of the following products:
 - a. Akzo Chemical; product "Trinar".
 - b. Glidden Company; product "Nubelar".
 - c. Morton International; product "Fluoroceram".
 - d. P.P.G. Industries Inc.; product "Duramar".
 - e. Valspar Corp., product: "Fluropon".
 - 3. Surface Preparation: Properly clean aluminum with inhibited chemical cleaner and pretreat with acid chromate-fluoride-phosphate conversion coating, in accordance with Aluminum Association method AA-C12C42.
 - 4. Shop-prime all surfaces with a corrosion resistant, epoxy-based primer compatible with finish coating, averaging 0.2 to 0.4 mils dry film thickness, fully oven-cured.
 - 5. Shop finish with one color coat, of polyvinylidene fluoride enamel minimum 1.0 to 0.80 mil dry film thickness on all exposed surfaces, including all exposed screws, fastenings.
 - 6. Total system dry film thickness: 1.2 mils.
 - 7. Color and Appearance: Color shall be from paint manufacturer's available library of non-exotic colors and shall match color sample furnished by Architect.
- B. Concealed Steel Items: Galvanized in accordance with ASTM A386 to 2.0 ounces per square foot.
- C. Apply one coat of bituminous paint to concealed aluminum surfaces in contact with cementitious or dissimilar materials.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Inspect all surfaces and verify that they are in proper condition to receive the work of this Section. Verify that prepared openings and flashings are ready to receive the work of this Section and opening dimensions are as indicated on the shop drawings. Verify that all blocking and nailers are set in place and secure.
- B. Beginning of installation means acceptance of existing project conditions.

3.2 INSTALLATION

- A. Install louver assembly in accordance with manufacturer's instructions. Erect louvers plumb and level, free of warp or twist. Maintain dimensional tolerances, aligning with adjacent work.

July 11, 2018

1. Install flashings and align louver assembly to ensure moisture shed from flashings and diversion of moisture to exterior.
 2. Secure louvers in opening framing with concealed fasteners.
- B. No permanent exposed to view labels of any kind will be permitted to remain on the louvers or frames.
- 3.3 TOLERANCES
- A. Maximum Variation from Level or Plumb: 0.06 inches every 3 feet non-cumulative or 0.5 inches per 100 feet, whichever is less.
- 3.4 CLEANING AND TOUCH UP
- A. Upon completion of the work of this Section in any given area, remove tools, equipment and all rubbish and debris from the work area; leave area in broom-clean condition.
- B. Remove excess sealant by solvent acceptable to sealant manufacturer. All exposed edges of sealant and gaskets shall be left smooth, uniform in line, and with edges neatly struck.
- C. Remove protective material from prefinished aluminum surfaces. Wash down exposed surfaces free of dirt, handling marks, packing tapes, and foreign matter, using a solution of mild detergent in warm water, applied with soft, clean wiping cloths. Take care to remove dirt from corners. Wipe surfaces clean.
- D. Touch-up all scratches, abrasions, and other defects in the prefinished metal surfaces with shop-coat finish material, supplied with the various items to be furnished hereunder.

End of Section

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Section 09 00 09
PAINTING FILED SUB-BID REQUIREMENTS
(FILED SUB-BID REQUIRED)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. The BIDDING REQUIREMENTS, CONTRACT FORMS, and CONTRACT CONDITIONS as listed in the Table of Contents, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Work of this Section requires Filed Sub-Bids and is governed by the provisions of the Massachusetts General Laws (MGL), Public Bidding Law - Chapter 149, Sections 44A to 44J inclusive, as amended, and applicable Sections of the MGL, Public Contract Law - Chapter 30.
- C. Specification requirements for the Filed Sub-Bid "PAINTING" includes all work of the following listed Specification Sections, in their entirety:
 - 1. Section 09 00 09 - Painting Filed Sub-Bid Requirements
 - 2. Section 09 91 00 - Painting
 - 3. Document 09 91 13 - Exterior Painting Schedule
 - 4. Document 09 91 23 - Interior Painting Schedule
- D. The work to be completed by the Filed Subcontractor for the work of this Section is shown on the following listed Drawings, not just those pertaining particularly to this Sub-Trade, unless specifically called out otherwise, regardless of where among the Drawings it appears:
 - G-001 TITLE SHEET
 - G-002 CODE SUMMARY, NOTES & DRAWING LIST
 - AD-101 EXISTING & SELECTIVE REMOVAL PLANS
 - A-100 BASEMENT PLAN
 - A-101 FIRST FLOOR PLAN
 - A-102 SECOND FLOOR PLAN
 - A-103 ROOF PLAN
 - A-104 REFLECTIVE CEILING PLANS
 - A-201 EXTERIOR ELEVATIONS
 - A-202 EXTERIOR ELEVATIONS
 - A-301 BUILDING SECTIONS
 - A-302 WALL SECTIONS
 - A-303 EXTERIOR DETAILS
 - A-401 INTERIOR STAIR 1
 - A-402 ELEVATOR
 - A-404 INTERIOR RAMP
 - A-405 STAIR 2
 - A-406 PORCH RAMP AND STAIR 3
 - A-407 STAIR 4 AND STAIR 5

A-408 TYPICAL EXTERIOR STAIR DETAILS
A-501 KITCHEN ENLARGED PLAN & INTERIOR ELEVATIONS
A-502 BATHROOM INTERIOR ELEVATIONS
A-503 INTERIOR DETAILS
A-701 PARTITION TYPES
A-702 DETAILS - EXTERIOR ENVELOPE
A-901 DOOR SCHEDULE & DETAILS
A-902 WINDOW SCHEDULES & DETAILS
A-903 FINISH SCHEDULE

- E. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the Work of this Filed Subcontract.
 - 1. Refer to Section 01 23 00 - ALTERNATES, for Bid alternates which may affect the scope of Work of this Section.
- F. Filed Sub-Bids for work under this Section shall be for the complete work and shall be submitted electronically to the Awarding Authority at time, and in manner stipulated in the INVITATION TO BID and INSTRUCTIONS TO BIDDERS.
 - 1. Each Sub-Bid submittal for work under this Section shall be accompanied with the required bid deposit.
- G. Sub Sub-Bid Requirements: NONE REQUIRED UNDER THIS SECTION.

1.2 EXAMINATION OF SITE AND DOCUMENTS

- A. 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 (Owner) will not be responsible for errors, omissions and/or charges for extra work arising from General Contractor's or Filed Subcontractor's failure to familiarize themselves with the Contract Documents or existing 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: Bidders are strongly encouraged to attend the Pre-Bid conference; refer to INVITATION TO BID for time and date.

1.3 SEQUENCING

- A. Coordinate work of this Filed Subcontract with that of other trades, affecting or affected by this work, and cooperate with the other trades as is necessary to assure the steady progress of work.
- B. Do not order or deliver any materials until all schedules and submittals, required in the listed Specification Sections included as part of this Filed Subcontract, have been received and approved by the Architect.
- C. Before proceeding with installation work, inspect all project conditions and all work of other trades to assure that all such conditions and work are suitable to satisfactorily receive the work of this Section and notify the Architect in writing of

any which are not. Do not proceed further until corrective work has been completed or waived.

PART 2 - PRODUCTS

2.1 SCAFFOLDING AND STAGING

- A. General: Filed Subcontractors shall obtain required permits for, and provide scaffolds, staging, and other similar raised platforms, required to access their Work as specified in Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS and herein.
 - 1. Scaffolding and staging required for use by this Filed Subcontractor pursuant to requirements of Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS shall be furnished, erected, maintained in a safe condition, and dismantled when no longer required, by this Filed Sub-Trade requiring such scaffolding.
 - 2. Each Filed Subcontractor is responsible to provide, maintain and remove at dismantling, all tarpaulins and similar protective measures necessary to cover scaffolding for inclement weather conditions other than those required to be provided, maintained and removed by the General Contractor pursuant to MGL (Refer to Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS and as additionally required for dust control).
 - 3. Furnishing portable ladders and mobile platforms of all required heights, which may be necessary to perform the work of this trade, are the responsibility this Filed Subcontractor.

2.2 HOISTING MACHINERY AND EQUIPMENT

- A. All hoisting equipment, rigging equipment, crane services and lift machinery required for the work by this Filed Subcontractor shall be furnished, installed, operated and maintained in safe conditions by this Filed Subcontractor, as referenced under Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS.

PART 3 - EXECUTION (Not Used)

End of Section

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Section 09 01 66
REFINISHING WOOD FLOORS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. The BIDDING REQUIREMENTS, CONTRACT FORMS, and CONTRACT CONDITIONS as listed in the Table of Contents, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. Perform complete sanding and finishing operations for exposed to view surfaces of all existing wood strip flooring scheduled to remain in place, including flooring patches, and wood edgings furnished hereunder.
 - 1. As part of the scope of this section, patch to match existing wood strip flooring as required.

1.3 RELATED REQUIREMENTS

- A. Section 03 30 00 - CAST-IN-PLACE CONCRETE: Concrete substrate.
- B. Section 09 91 00 - PAINTING: Field applied surface finish to flooring.

1.4 REFERENCES

- A. Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
 - 1. ASTM E 84 - Surface Burning Characteristics of Building Materials.
 - 2. FS MM-L-736 - Lumber; Hardwood.
 - 3. WSFI - Recommendations for the Correct Preparation, Finishing, and Testing of Concrete Subfloor Surfaces to Receive Wood Flooring.
 - 4. All applicable federal, state and municipal codes, laws and regulations regarding flammability and smoke generation of interior finishes.

1.5 SUBMITTALS

- A. Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
 - 1. Literature: Manufacturer's product data sheets, specifications, performance data for each type of wood flooring [and finish system] materials, with manufacturer's installation instructions and recommended maintenance procedures.
 - 2. Installation instructions: Submit manufacturer's instructions, indicating special procedures, and perimeter conditions requiring special attention.

3. Manufacturer's warranties: Wood flooring and finish system manufacturers' standard written guarantees covering defects in materials and workmanship, clearly defining the terms included in the coverage.
 4. Shop drawings: Indicate floor joint pattern and termination details.
 5. Verification samples:
 - a. Strip flooring: At least six (6) 12-inch long pieces of specified specie, grade, and size of flooring, indicating complete range of color variation which may be expected for the project.
 - b. 12 x 12 inch sample of Repurposed Gym Floor (over plywood) with eggshell, semi-gloss and gloss finish for architect selection (3 samples). Each sample board must contain one area of existing paint striping for reference.
- B. Submit the following under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS:
1. Maintenance data: Include maintenance procedures, recommended maintenance materials, a suggested schedule for cleaning, stripping, and re-finishing, stain removal methods, and polishes and waxes.

1.6 QUALITY ASSURANCE

- A. Manufacturer: Companies specializing in manufacturing the products specified in this Section, each with minimum 5 years documented experience.
- B. Installer specializing in applying the work of this Section with a minimum of 5 years documented experience of the type of flooring system specified.
- C. Each board of flooring shall bear grade stamp on underside identifying Grading authority, manufacturer's identification, wood species and grade.

1.7 REGULATORY REQUIREMENTS

- A. Conform to applicable codes for Class 1 flame spread rating of finished floor surface when tested in accordance with ASTM E 84. Provide certificate of compliance from authority having jurisdiction.

1.8 DELIVERY, STORAGE AND HANDLING

- A. Deliver wood flooring a minimum of 7 days prior to installation to allow materials moisture content to stabilize to ambient conditions. Do not deliver wood until all concrete, masonry, plaster and other wet work is complete and dry, and ambient air at installation space has moisture content stabilized.
- B. Protect wood flooring from excessive moisture in shipment and handling; store all materials in an elevated, protected, and dry location.

1.9 PROJECT CONDITIONS

- A. Maintain ambient temperature between 55 and 80 degrees Fahrenheit, with a relative humidity of between 35 and 50 percent for 48 hours prior to delivery and storage of the flooring materials at the area; maintain such conditions throughout the installation and finishing period, and thereafter until Owner's Final Acceptance or Owner's occupancy.

July 11, 2018

1.10 SEQUENCING AND SCHEDULING

- A. Sequence work to ensure wood flooring is not delivered until building is enclosed, sufficient heat is provided, and proper humidity conditions can be maintained.
- B. Install wood flooring after interior wet work is complete and fully cured, and ambient air at installation space has a moisture content stabilized.

1.11 WARRANTY

- A. Provide 5 year warranty under provisions of the Section 01 78 00 - CLOSEOUT SUBMITTALS. Warranty shall include coverage for all costs to repair or replace flooring, which shrinks, warps, cracks, or otherwise deteriorates excessively, or which breaks its anchorage, or bond with substrate, or otherwise fails. Warranty shall cover failures due to materials or workmanship. The Installer is not responsible for failure due to excessive moisture penetration through concrete substrate or other similar causes for failure which are beyond the Work of this Section, except verification of acceptable substrates, specified herein.

1.12 EXTRA MATERIALS

- A. Upon completion of the Work of this Section, deliver to the Owner extra materials for future repairs and maintenance, an amount equal to [10] square feet of finish and type flooring installed, with an appropriate quantity of adhesive for installation.
- B. Clearly label and package extra materials securely to prevent damage.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Finishing:
 - 1. Sandpapers: Number 1-1/2 graduating to 1/2; followed by Numbers 0 and 00 for final sanding, except as otherwise recommended by the flooring manufacturer.
 - 2. Filler: Paste wood filler, in tone as selected by the Architect.
 - 3. Floor finish: Water base catalyzed urethane coating system, as manufactured by Basic Coatings, Des Moines IA., product "Street ShoeXL Commercial Wood Floor Finish".
 - a. VOC: Catalyzed, not exceed 350 grams per liter.
 - b. Solids content: 31 percent.
 - c. Luster Satin finish, 30 units at 60 degrees on wood.

2.2 ACCESSORIES

- A. Protection paper: Waxed kraft paper. or red rosin paper.
- B. Fasteners:
 - 1. Fasteners for plywood underlayment: Power-actuated fasteners of appropriate size for the specific substrate.

2. Fasteners for flooring: 7d or 8d cut nails or screw-type nails, or other fasteners as recommended by the flooring manufacturer, for blind-method installation over plywood underlayment.
- C. Filler for patching, smoothing and leveling subfloors and underlayment: Portland cement-based latex underlayment acceptable to flooring manufacturer, equal to the following:
 1. Ardex, Inc., products "Feather Flash" and "Ardex SD-P".
 2. Quikrete Companies, product "Fast-Set Underlayment 1248".
 3. Silpro Masonry Systems Inc., product "Masco Latex Cement"

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify concrete substrate has cured for at least 60 days. Test concrete with 3 percent solution of phenolphthalein in grain alcohol for dryness. Do not proceed with installation until substrate passes dryness test, immediately notify Architect of unacceptable substrate conditions.
- B. Verify that permanent heat, light, and ventilation is complete and operational prior to installation.
- C. Inspect all substrate surfaces and verify that they are in proper condition to receive the work of this Section.
 1. Verify that concrete substrate surfaces are smooth and flat to plus or minus 1/8 inch in 10 feet, free of scaling, oil, grease, dust, and foreign substance.
 2. Verify that wood subfloor is properly secured, is smooth and flat to plus or minus 1/8 inch in 10 feet, free of foreign substances.
- D. Verify that required flooring mounted utilities are in proper location.
- E. Beginning of installation means acceptance of existing substrate and site conditions.

3.2 PREPARATION

- A. Comply with flooring manufacturer's requirements for preparation of substrate to receive wood flooring.
- B. Remove sub-floor ridges and bumps. Fill minor or local low spots, cracks, joints, holes, and other defects with subfloor filler to achieve smooth, flat, hard surface. Prohibit traffic until filler is cured.
- C. Thoroughly vacuum clean / broom-clean all receiving surfaces before commencing installation work.
- D. Open bundles of flooring, and permit the pieces to properly acclimatize prior to installing same.

3.3 INSTALLATION / PATCHING OF IN SITU FLOORING

- A. Remove existing floor board to be replaced by cutting with a saw as follows:

July 11, 2018

1. Set saw at a depth not to exceed the thickness of the existing flooring making two passes approximately 1/2 inch from each side of the adjacent floor boards.
2. Do not cut past the end joints of the piece being replaced.
3. Create a third cut on an angle between the first two cuts avoid cutting through the side match. Use a sharp chisel to remove the cut pieces.
4. Clean and vacuum the groove and area around the repair, making sure all debris is removed.

B. Install replacement flooring:

1. Cut the replacement piece of flooring to the exact length and ensure a tight fit with no cracks at the end joints.
2. Remove the bottom of the groove of the replacement board. Bevel each end of the board. Dry fit the replacement piece before installation.
3. Install the replacement board using a two-part epoxy adhesive recommended by the flooring manufacturer. Apply adhesive in the groove and on the tongue of the existing boards adjoining the repair and the tongue and groove on the replacement piece. Allow adhesive to set for a minimum of 8 hours prior to sanding and refinishing.

3.4 CLEANING AND REFINISHING EXISTING FLOORING

- A. Nail loose boards and patch existing flooring with wood plugs.
- B. Remove dirt and built-up waxes by wiping floors with mop or cloth moistened with mineral spirits, or sealer as recommended by Maple Flooring Manufacturers Association and sealer/finish manufacturer, and immediately wipe dry. Remove white spots using specialized wood floor cleaners; remove all rubber heel marks, wipe areas dry.
 1. Review with Architect in field stained areas of existing flooring, lightly sand where directed to remove stains..
- C. Touch-up existing finish staining to match color and shade, and allow to thoroughly dry.

3.5 FINISHING

- A. Prior to commencing application of finishing products, measure moisture content of flooring using moisture meter, and record results.
- B. Stain wood to color and tone to match architect's accepted sample, applying stain at approximately 100 square feet per gallon; allow stain to fully dry, verify with moisture meter.
- C. When stain has cured, apply one coat of Basic Coatings product "Hydroline sealer" as recommended by manufacturer. When that moisture content of wood is same as original prior to application, sand/buff coat with a used 120 grit screen.
- D. Vacuum up all dust and tack with a clean water dampened towel. Apply second coat of sealer and, repeat sanding and cleaning procedures.

- E. Permit sealer to dry overnight prior to finishing with catalyzed urethane. Re-sand and clean as required.
- F. Mix catalyst with urethane in strict adherence to manufacturers' instructions. Apply one coat of catalyzed urethane with a coverage rate as recommended by manufacturer. When manufacturer recommends first coat should be dry, check the moisture content of wood. When moisture content is same as original prior to application, sand with used 120 grit screen, clean and apply second coat. This should occur between 3 and 5 hours after first coat. If more than 5 hours has lapsed prior to starting the second coat of urethane, repeat sanding and cleaning procedures specified above and apply second coat.

3.6 CLEANING

- A. Daily clean work areas by sweeping and disposing of scraps and sawdust.
- B. As work progresses, remove excess adhesive from floor, base and wall surfaces without damage.
- C. Upon completion of the work of this Section in any given area, remove tools, equipment and all rubbish and debris from the work area; leave area in broom-clean condition.
- D. Clean and polish floor surfaces in accordance with manufacturer's instructions.

3.7 PROTECTION

- A. Provide protection of completed flooring areas from construction traffic until Substantial Completion of the General Contract. Prohibit construction traffic for a minimum of 48 hours on completed areas of adhesive applied flooring.
- B. Cover the all wood floor surfaces, facings, and edgings, with heavyweight non-staining kraft paper and overlay with red-rosin paper, taping the edges to maintain position of the protection paper. Reapply papers as required to maintain floor protection.

End of Section

Section 09 05 60
COMMON WORK RESULTS FOR FLOORING

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. The BIDDING REQUIREMENTS, CONTRACT FORMS, and CONTRACT CONDITIONS as listed in the Table of Contents, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. This Section includes general requirements for flooring preparation, installation and temporary protection.
 - 1. Provide independent testing laboratory services to perform relative humidity, moisture vapor emission, and pH tests on in situ concrete slabs, which shall be in addition to testing as may be performed by Owner.
 - 2. Prepare substrates to receive resilient tile flooring as required to ensure specified tolerance level for finish surface of floor tile. Preparation work includes patching, smoothing and leveling substrate, including:
 - a. Grinding down high spots of substrate.
 - b. Providing Portland cement-based latex underlayment (filler).

1.3 RELATED REQUIREMENTS

- A. Section 03 05 13 - CONCRETE SEALERS.
- B. Section 09 01 66 - REFINISHING WOOD FLOORS.
- C. Section 09 30 00 - TILING.
- D. Section 09 64 29 - WOOD STRIP FLOORING.
- E. Section 09 65 20 - RESILIENT PLANK FLOORING.
- F. Section 09 65 23 - RUBBER FLOORING.
- G. Section 09 68 00 - CARPETING.

1.4 REFERENCES

- A. Referenced Standards: Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. The standards referenced herein are included to establish recognized minimum quality only. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern. Equivalent quality and testing standards will be acceptable, subject to their timely submission, review and acceptance by the Architect.

1. ASTM D 4259 - Standard Practice for Abrading Concrete.
2. ASTM E 329 - Standard Specification for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction.
3. ASTM E 1907 - Standard Guide to Methods of Evaluating Moisture Conditions of Concrete Floors to Receive Resilient Floor Coverings
4. ASTM F-710 - Preparing Concrete Floors to Receive Resilient Flooring.
5. ASTM F 1482 - Standard Practice for Installation and Preparation of Panel Type Underlayments to Receive Resilient Flooring.
6. ASTM F 1869 – Standard Test Method for Measuring Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.
7. ASTM F 2170 – Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using In-Situ Probes
8. ASTM F 3010 - Standard Practice for Two-Component Resin Based Membrane-Forming Moisture Mitigation Systems for Use Under Resilient Floor Coverings.
9. All applicable federal, state and municipal codes, laws and regulations regarding flammability and smoke generation of interior finishes.

1.5 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 1. General: Coordinate flooring work with the respective trades responsible for installing interfacing and adjoining work for proper sequence of installation, and ensure that the work performed hereunder is acceptable to such trades for the installation of their work.

- B. Pre-Installation Meetings: At least 30 calendar days prior to commencing any flooring work, conduct a pre-installation conference at the Project site. Comply with requirements of Section 01 31 00 - PROJECT MANAGEMENT AND COORDINATION. Coordinate time of meeting to occur prior to installation of work under the related sections named below.
 1. Required attendees:
 - a. Owner.
 - b. Architect.
 - c. General Contractor.
 - d. Project Superintendents representing each floor system installer.
 - e. Manufacturer's technical representative(s) for flooring products as designated by Architect or Contractor.
 - f. Representatives of related trades as directed by the Architect or Contractor, and representatives for installers of related work specified under the following Sections:
 - 1) Section 03 05 13 - Concrete Sealers.
 - 2) Section 09 01 66 - Refinishing Wood Floors.
 - 3) Section 09 30 00 - Tiling.
 - 4) Section 09 64 29 - Wood Strip Flooring.
 - 5) Section 09 65 20 - Resilient Plank Flooring.
 - 6) Section 09 65 23 - Rubber Flooring.

7) Section 09 68 00 - Carpeting.

2. Agenda:
 - a. Scheduling of preparation and flooring operations.
 - b. Procedures for testing of relative humidity and moisture content of in situ substrates.
 - c. Water vapor emission control methods.
 - d. Review of staging and material storage locations.
 - e. Coordination of work by other trades.
 - f. Protection of completed Work.
 - g. Establish humidity and temperature limitations for performing the work, to which Architect and Contractor must agree.
 - h. Discuss process for inspection and acceptance of completed Work of this Section.

C. Sequencing:

1. Sequence work to ensure flooring is not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, wet work is dry and cured, and work overhead is completed.
2. Field Measurements
 - a. Take field measurements before preparation of shop drawings and fabrication, where possible, to ensure proper fitting of Work.
 - b. Allow for adjustments within specified tolerances wherever taking of field measurements before fabrication might delay Work.
3. Ensure that installation of flooring and accessories occurs after other finishing operations, including painting.

1.6 SUBMITTALS

- A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
 1. Test and Evaluation Reports: Include the following:
 - a. Report the test deployment parameters at start of testing and finishing of testing:
 - 1) Start and finish dates and times of testing.
 - 2) Ambient temperature.
 - 3) Ambient relative humidity and dew point temperature.
 - 4) Minimum and maximum ambient temperature and relative humidity reached during testing.
 - b. Report the "factor" used to calculate the actual test area of the calcium chloride test site.
 - c. Report the concrete slab thickness (in inches).
 - d. Report the Demolition Parameters for moisture vapor emission (MVER) testing: The start and finish date and time of removing existing non-asbestos flooring and adhesives, prior to MVER testing.
 - e. Report all test results in chart form listing the following:

- 1) Test locations (also mark test locations on floor plan).
 - 2) Type(s) of existing floor coverings.
 - 3) Visual distress level of existing floor coverings.
 - 4) Surface temperature of concrete.
 - 5) pH paper/ pencil reading (ASTM F 710).
 - 6) Visual appearance of concrete.
 - 7) Concrete slab age.
 - 8) Relative humidity in concrete, % (ASTM F 2170):
 - a) Depth of hole from top of slab, inches.
 - b) RH in concrete, %.
 - c) Temperature in concrete, °F.
 - 9) Surface moisture meter test (ASTM E 1907):
 - a) Electrical impedance test values.
 - b) Electrical resistance test values.
 - 10) Moisture vapor emission (MVER) - CaC12 test (ASTM F 1869):
 - a) Weight gain in grams.
 - b) Exposure time/hours.
 - c) MVER Lbs/1000 sq. ft./24 hours.
- f. Report all unacceptable substrate and field conditions observed during testing.
- B. Submit 1 copy of test data to the installers of all flooring materials or floor surface coating materials scheduled to be installed.

1.7 QUALITY ASSURANCE

- A. General: perform relative humidity, moisture vapor emission (MVER) and acidity/alkalinity (pH) Testing for concrete slabs and floors.
1. General Contractor shall employ and pay for services of an independent testing laboratory to perform relative humidity, moisture vapor emission, and pH tests on concrete slabs as follows. The test shall be witnessed by the Contractor, flooring subcontractors and Owner's Project Representative.
 - a. Relative Humidity, Moisture Vapor Emission and pH Testing on all concrete slabs over-which a finished floor is to be installed. This includes, but is not limited to:
 - 1) Resilient plank flooring.
 - 2) Rubber stair treads and flooring.
 - 3) Concrete sealers.
 - 4) Carpet.
 - 5) Wood flooring of all types.
 - b. Perform moisture and pH tests on all concrete floors over-which stone flooring is to be applied.
 2. Testing Requirements: As specified under Part 3 of this Section.
 - a. Provide additional testing in the event test results indicate higher moisture content than recommended by the flooring material and coating material manufacturers for the installation of their products.

July 11, 2018

- 1) Perform additional testing after procedures have been performed by the General Contractor to reduce moisture content to ratings acceptable to the various flooring and floor-coating manufacturers. General Contractor's procedures to reduce moisture content may consist of project dehumidification and temporary heating, environmental controls, or moisture mitigation treatment to concrete.

PART 2 - PRODUCTS

2.1 GENERAL FLOORING ACCESSORIES

- A. Filler for patching, smoothing and leveling subfloors and underlayments: Portland cement-based latex underlayment acceptable to flooring manufacturer, equal to the following:
 1. Ardex Americas, Aliquippa, PA., products "Feather Flash" and "Ardex SD-P".
 1. Ardex Americas, Aliquippa, PA., products "Forti Finish".
 2. Quikrete Companies., Atlanta, GA., product "Fast-Set Underlayment 1248".
 3. Silpro Corp., Ayer MA., product "Profinish".
- B. Adhered flooring systems general requirements for adhesives (except as otherwise specified in individual Specification Sections):
 1. General Flooring Adhesives: High moisture resistant and alkali resistant adhesive: Synthetic Polymer, non-flammable in wet state, with NFPA, Class A rated, VOC compliant, capable of withstanding the following in continuous service:
 - a. Up to 90% relative humidity when measured in accordance with ASTM F2170 – Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in-situ Probes.
 - b. Up to 8 lbs./1000 sq. ft./ 24 hours MVER when measured in accordance with ASTM F1869 - Standard Test Method for Measuring Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.
 - c. VOC content: Less than 50 g/L.
 2. Acceptable adhesives, include the following, or approved equal, (subject to acceptance of flooring manufacturer for performance and compliance with warranty requirements, for each type of floor system specified):
 - a. Advanced Adhesive Technology Inc., Dalton GA.
 - 1) Adhesive: "AAT-270" (maximum 80% RH / 3 pounds MVER).
 - 2) Adhesive: "AAT-675" (maximum 85% RH / 5 pounds MVER).
 - b. Armstrong World Industries, Inc., Flooring Division, Lancaster PA., adhesive: "S-515" (maximum 90% RH / 5 pounds MVER).
 - c. DriTac Corp., Clifton NJ., adhesive: "5900 Mega Bond" (maximum 90% RH / 8 pounds MVER).
 - d. W.W. Henry Company, Aliquippa PA.
 - 1) Adhesive: "640 Vinyllock" (maximum 90% RH / 3 pounds MVER).
 - 2) Adhesive: "430 ClearPro" (maximum 90% RH / 8 pounds MVER).
 - e. Johnsonite, Middlefield OH., adhesive: "SpraySmart" (maximum 90% RH / 8 pounds MVER).

- f. Mapei Corporation, Elk Grove IL:
 - 1) Adhesive: "Ultrabond ECO 360" (maximum 80% RH / 5 pounds MVER).
 - 2) Adhesive: "Ultrabond ECO 711" (maximum 95% RH / 8 pounds MVER).
 - g. Roberts Consolidated Industries, Inc., City of Industry, CA., adhesive: 7350 (maximum 90% RH / 10 pounds MVER).
 - h. Titebond, Columbus, OH., adhesive "Titebond 670 Resilient Flooring Adhesive" (maximum 90% RH / 8 pounds MVER).
- C. Temporary Floor Protection: Flame retardant treated in conformance with NFPA 701. Acceptable Products include the following, or approved equal:
- 1. Holland Manufacturing, Succasunna NJ., product: "Blue Shield Flame StopR."
 - 2. Pro Tect Associates, Northbrook, IL, product "Traffic Guard."
 - 3. Protection from the Ground Up, Escondido, CA., product "Deck Cover FR."
 - 4. Surface Shields, Orland Park, IL, product "Cover Shield."

2.2 TESTING EQUIPMENT

- A. For relative humidity testing: Digital Meter and Calibrated Humidity and Temperature probe kit in Compliance with ASTM F 2170.
 - a. Minimum 2 point probe calibration.
- B. For calcium chloride testing: Anhydrous calcium chloride testing in accordance with Rubber Manufacturer's Association (RMA) Test requirements and in compliance with ASTM F 1869.
- C. For pH testing: In compliance with ASTM F710.
 - 1. pH test paper.
 - 2. Distilled or de ionized water.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that spaces to receive flooring finishes are suitable for installation. Do not proceed with work until unsatisfactory conditions are corrected. Comply with manufacturer's recommendations including the following:
 - 1. Substrates shall be dry and clean.
 - 2. Substrates shall be free of depressions, raised areas, or other defects which would telegraph through installed flooring.
 - 3. Verify concrete substrates have a flat tolerance of 3/16" in 10 linear feet, or more restrictive tolerances as specified under individual flooring Specification Sections.
 - 4. Temperature of flooring and substrate shall be within specified tolerances as required by flooring and adhesive manufacturers.
 - 5. Moisture condition and adhesive bond tests shall be performed as specified herein.

July 11, 2018

- B. For applications on concrete:
 - 1. Verify concrete substrate has been cured and is sufficiently dry to achieve a bond with the adhesive, in accordance with the manufacturer's recommended bond and moisture test
 - 2. Verify curing, hardening, or breaking compounds have not been used. If there are any, do not proceed until compounds have been removed as specified.
 - 3. For applications on concrete slab on grade or below grade, verify vapor barrier below slab was installed. If no vapor barrier was installed, do not proceed with work unless written acceptance of such conditions is received and submitted.
 - 4. Perform testing of in situ concrete, relative humidity and surface pH testing to all concrete slabs specified to be covered with floor coverings or resinous coatings as specified herein. Do not proceed with work until results of moisture condition tests are acceptable.
- C. For applications on wood substrate:
 - 1. Verify wood substrates are installed sound, rigid, smooth, flat, clean and permanently dry.
 - 2. Verify wood surface is free of all contaminants, including sawdust.
 - 3. Verify wood subfloors are constructed of double layer underlayment, and having a minimum total thickness of not less than 1 inch.

3.2 SURFACE PREPARATION FOR TESTING

- A. General: Substrates shall be dry and clean. Remove all adhesive residue, dirt, debris, sealers, coatings, finishes, film-forming curing compounds, and other substances which may affect the rate of moisture dissipation. Remove all dust by vacuum or other methods. Do not use chemicals of any kind to clean concrete.
 - 1. Non- chemical methods for removal, such as abrasive grinding or bead-blasting, including methods described in ASTM D 4259 may be used on existing slabs with deleterious residues to achieve an appropriate state for testing.
 - 2. Remove existing floor coverings and adhesives down to bare slab. Remove existing floor coverings not less than 24 hours prior to scheduled testing.
 - a. Where new flooring is being indicated to be installed over existing flooring, remove and expose substrate a minimum area of 24 by 24 inches at each test location.
- B. To test for pH at the surface of a concrete slab, use care not to over abrade the surface of the concrete which can result in overstated pH readings.

3.3 TESTING IN SITU CONCRETE SUBSTRATES

- A. Scope:
 - 1. Provide in situ concrete relative humidity and surface pH testing to all concrete slabs specified to be covered with floor coverings or resinous coatings. Includes concrete placed as part of this Work which occurs below grade, above grade (suspended slabs), and slabs on grade.

- a. Existing building suspended slabs may be excluded from this requirement.
- B. Scheduling:
1. Testing shall take place after allowing concrete to dry for a minimum of 90 days. Testing to be scheduled no less than one, nor more than three weeks prior to scheduled flooring installation.
 - a. DO NOT conduct testing unless the slab environment is identical to that in which the finished flooring is to be installed.
 2. In the event new flooring is to be installed over existing resilient flooring, remove the portion of the existing flooring and adhesive directly under the area where testing will be conducted. Patch flooring to match existing construction after completion of testing.
- C. Test result submittals:
1. Report all test results in chart form listing test dates, time, depth of test well, in situ temperature, relative humidity, moisture vapor and pH levels.
 2. List test locations on chart and show same on marked up Floor Plan Drawings.
 3. Submit results in duplicate. Deliver copies directly to Architect, Owner's Project Representative and General Contractor.
- D. Testing Procedures, quantification of Relative Humidity
1. The test site should be maintained at the same temperature and humidity conditions as those anticipated during normal occupancy. These temperature and humidity levels should be maintained for 48 hours prior and during test period. If meeting this criteria is not possible, then minimum conditions should be 75 degrees F (plus or minus 10 degrees F), and 50 percent (plus or minus 10 percent) relative humidity. When a building is not under HVAC control, a recording hygrometer or data logger shall be in place recording conditions during the test period. A transcript of this information must be included with the test report.
 2. The number of in situ relative humidity test sites is determined by the square footage of the facility. The minimum number of tests to be placed is equal to 3 in the first 1,000 square feet and 1 per each additional 1,000 square feet.
 3. Drill test holes utilizing a roto hammer drill. Hole diameter shall not exceed outside diameter of the insertable test sleeve by more than 0.04 inch (1mm). Drilling operation must be dry. Do not use water for cooling or lubrication; do not wet-core test hole. Determine the thickness of the concrete slab from Construction Documents. Depths of test holes shall be as follows:
 - a. For elevated slabs (not poured in pans): Drill test holes to a depth equal to 20 percent of the concrete thickness.
 - b. For slabs on grade and elevated slabs in pans: Drill test holes to a depth equal to 40 percent of the concrete thickness.
 4. Vacuum all concrete dust from test hole.
 5. Insert a hole liner, or sleeve, to the full depth of test hole, assuring that the liner is capped or plugged at the end protruding from the concrete surface.

6. Permit the test site to acclimate, or equilibrate, for 72 hours prior to taking relative humidity readings.
 7. Remove the sleeve plug and place a probe into the sleeve assuring that it reaches the bottom of the test hole.
 8. Allow the probe to sit in the test sleeve for 30 minutes before taking readings.
 9. Read and record temperature and relative humidity at the test site.
- E. Testing Procedures, quantification of concrete moisture vapor emission through Calcium Chloride Testing:
1. The test site should be maintained at the same temperature and humidity conditions as those anticipated during normal occupancy. These temperature and humidity levels should be maintained for 48 hours prior and during test period. If meeting this criteria is not possible, then minimum conditions should be 75 degrees F (plus or minus 10 degrees F) and 50 percent relative humidity (plus or minus 10 percent). When a building is not under HVAC control, a recording hygrometer or data logger shall be in place recording conditions during the test period. A transcript of this information must be included with the test report.
 2. The number of vapor emission test sites is determined by the square footage of the facility. The minimum number of tests to be placed is equal to 3 in the first 1,000 square feet and 1 per each additional 1,000 square feet.
 3. Test sites are to be cleaned of all adhesive residue, curing compounds, paints, sealers, floor coverings, and similar materials. 24 hours prior to the placement of test kits.
 4. Weigh test dish on site prior to start of test. Scale must report weight to 0.1 grams. Record weight and start time.
 5. Expose Calcium Chloride and set dish on concrete surface.
 6. Install test containment dome and allow test to proceed for 60 to 72 hours.
 7. Retrieve test dish by carefully cutting through containment dome. Close and reseal test dish.
 8. Weigh test dish on site recording weight and stop time.
 9. Calculate and report results as pounds of emission per 1,000 square feet per 24 hours."
- F. Testing Procedures, quantification of Acidity/Alkalinity (pH) Level:
1. At or near the relative humidity test site and each vapor emission (calcium chloride) test site, perform pH test.
 - a. At each testing site, lay down a loose 2 foot by 2 foot sheet of non perforated sheet backed by plywood. Leave in place for 48 hours.
 - b. Remove sheet and place several drops of distilled or de ionized water onto the concrete surface to form a puddle approximately 1 inches in diameter.
 - c. Allow the water to set for approximately 60 seconds.
 - d. Dip the pH paper into the water and remove immediately, compare color to chart provided by paper supplier to determine pH reading
 2. Record and report results.

- G. Testing Procedures:
1. Initial testing: Provide 3 tests for the first 1,000 square feet.
 2. Add one test for each additional 1,000 square feet.
 3. Concrete surface area to be tested shall be completely clean as specified herein under Preparation.
 4. Perform moisture tests in strict accordance with the kit manufacturer's Instructions. Moisture tests shall remain undisturbed for 60 to 72 hours.
 5. Immediately after moisture test has been removed from test area, conduct pH test in area previously covered by plastic dome of moisture test kit.
 6. After completion of tests submit 2 copies of test data to the Architect. Submit a copy of the test data to all installers of flooring materials and resinous flooring materials scheduled to be installed.
 7. Provide additional testing in the event test results indicate higher moisture content than recommended by the flooring material and coating material manufacturers for the installation of their products. Perform such additional testing, at no additional cost to the Owner, after procedures have been performed to reduce moisture content to ratings acceptable to the various flooring and coating manufacturers.

3.4 FLOORING PREPARATION – GENERAL REQUIREMENTS

- A. Close spaces to pedestrian and worker traffic during the installation of the flooring.
- B. General: Comply with ASTM F 710 and manufacturer's recommendations for surface preparation. Remove substances incompatible with resilient flooring adhesive by method acceptable to manufacturer.
1. Fill voids, cracks, and depressions with trowel-applied leveling compounds acceptable to manufacturer. Remove projections and repair other defects to tolerances acceptable to manufacturer.
 2. Remove, by light sanding and grinding, all protruding edges, high spots.
 3. Ensure substrate is flat to a plus or minus 1/8 inch in 10 feet tolerance. Fill minor or local low spots, cracks, joints, holes, and other defects with subfloor filler to achieve smooth, flat, hard surface. Prohibit traffic until filler is cured.
 4. Ensure that substrate is free from paint, varnish, wax, oil, existing adhesive residue, or other foreign matter.
 5. For concrete substrates:
 - a. Concrete floors with steel troweled (slick) finish shall be properly roughened up (sanded) to ensure suitable adhesion.
 - b. Concrete floors with curing, hardening, and breaking compounds shall be abraded with mechanical methods only to remove compounds. Use blastrac or similar equipment.
 6. For Wood Substrates: Prepare substrate in accordance with manufacturer's recommendations and ASTM F 1482.
- C. Removal of existing coatings and adhesives:
1. Painted flooring substrates: Remove all existing coatings on flooring substrates. Certain paints may contain lead. Conform to federal, state and

local laws regarding appropriate methods for identifying lead-based paint and removing such paint, and notify Owner if lead-based paint has been identified.

- a. Remove existing visible lead-based paint in compliance with applicable regulations and requirements of governing agencies having jurisdiction
 - b. Isolate work areas from other workers of this project, provide air sampling results and worker exposure samples as required by referenced regulations. Contractor is responsible for worker safety and environmental exposure of contaminants during the performance of this Work.
 - c. Remove all paint chips and debris using HFOA vacuums. Dispose of caustic waste, paint chips in compliance with Resource Conservation and Recovery Act (RCRA) and all other EPA, state and local authority requirements as might be applicable.
2. In situ adhesive on flooring substrates: Use of commercial adhesive removers may adversely affect the bonding of a new flooring covering. Comply with The Resilient Floor Covering Institute (RFCI) publication "*Recommended Work Practices for Removal of Resilient Flooring Coverings*" and flooring product manufacturer's written instructions and technical advisories for removal of existing adhesives, so substrate is acceptable for new flooring installation and warranty.
 3. In situ asphalt-based adhesive on flooring substrates: Contact flooring product manufacturer's technical representative to obtain instructions for removal of existing asphalt-base adhesives, so substrate is acceptable for new flooring installation and warranty.
- D. Protection of In-situ Conditions: During the operation of flooring work, protect existing finishes against undue soilage and damage by the exercise of reasonable care and precautions. Clean, or repair all existing materials which are soiled or otherwise damaged by Work, to match original profiles and finishes. Existing materials and finishes which cannot be cleaned, or repaired shall be removed and replaced with new work to match existing.
- E. Use HEPA Vacuum to clean substrate, and ensure that substrate is dry, clean and smooth prior to application of flooring. Perform vacuuming immediately prior to installation.
- F. Apply primers as recommended by adhesive manufacturer's written instructions.
- G. Condition flooring materials, accessories and adhesives to room temperatures for a period of 48 hours minimum, and as additionally required under individual Specification Sections.

3.5 FLOORING INSTALLATION GENERAL

- A. Install all products in strict accordance with each manufacturer's written installation procedures and other provisions specified herein.
1. Apply primers as recommended by adhesive manufacturer's written instructions.

July 11, 2018

3.6 ADHESIVE BOND TESTING

- A. Use the specified flooring and recommended adhesive, install approximately 36 by 36 inch sized flooring as specified under individual flooring specification sections. Install test samples approximately 50 feet apart throughout the area, but not less than 1 test per 1000 square feet. Areas next to walls or other light traffic areas should be selected for the bond test. Tape down the perimeter of the flooring to prevent drying of the adhesive at the edges. After a minimum period of 72 hours the flooring should be pulled from the subfloor. If an unusual amount of force is required, the bond could be considered sufficient. Floors demonstrating unsuitable bond to substrate require modifications to flooring installation and may require application of moisture mitigation products. Review all conditions with Architect/Engineer.

3.7 PROTECTION

- A. Provide protection of completed flooring areas from construction traffic until Substantial Completion of the General Contract. Cover all floor surfaces with fire-resistant temporary floor protection, taping the edges to maintain position of the protection paper. Reapply papers as required to maintain floor protection.

End of Section

Section 09 29 00
GYPSUM BOARD

PART 1 – GENERAL

1.1 GENERAL PROVISIONS

- A. The CONTRACT FORMS, and CONTRACT CONDITIONS as listed in the Table of Contents, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. The work of this Section consists of gypsum board (drywall) and trim finishes for partitions, ceilings, and soffits, where shown on the Drawings, as specified herein, and as required for a complete and proper installation. Work includes, but is not limited to the following scope.
- B. Patch all existing gypsum board finishes disturbed by new construction.
 - 1. Patch cracks, holes and defects in existing gypsum wall-board surfaces which are to remain and which are indicated or as additional required by field conditions requiring a painted or applied wall-covering finish.
- C. Furnish and install:
 - 1. Taped, compounded and sanded gypsum board finishes.
 - 2. All trim and accessory components related to gypsum board work. Acoustical joint sealant and backing at perimeter of gypsum board partitions.
 - 3. Factory prefabricated partition closure mullions where gypsum board partitions terminate at windows, curtainwall and storefront framing
- D. Install access panels occurring in gypsum board work furnished by Section 08 31 00 - ACCESS DOORS AND PANELS, and by trades requiring the same.

1.3 RELATED REQUIREMENTS

- A. Section 01 73 29 - CUTTING AND PATCHING: Procedural and administrative requirements for cutting and patching.
- B. Section 02 41 19 - SELECTIVE DEMOLITION: Removal of existing finishes, partitions and walls as indicated in the Drawings.
- C. Section 05 40 00 - COLD-FORMED METAL FRAMING: Load bearing framing.
- D. Section 06 10 00 - ROUGH CARPENTRY:
 - 1. Supplemental wood framing and blocking supporting gypsum board.
 - 2. Installation of metal door frames in gypsum board work.
- E. Section 06 16 00 - SHEATHING: Wall sheathing.

July 11, 2018

- F. Section 07 21 00 - THERMAL INSULATION.
- G. Section 08 11 13 - HOLLOW METAL DOORS AND FRAMES: Furnishing steel door frames.
- H. Section 08 31 00 - ACCESS DOORS AND PANELS: Shop primed access panels, occurring in partitions and walls.
- I. Section 09 22 16 - NON-STRUCTURAL METAL FRAMING:
 - 1. Non-load bearing partition, ceiling and soffit framing and furring.
 - 2. Deflection track assemblies at tops of metal stud partitions.
- J. Section 09 81 00 – ACOUSTICAL INSULATION: acoustical batt insulation.
- K. Section 09 91 00 - PAINTING: Applied finish coatings.
- L. Section 10 40 00 - SAFETY SPECIALTIES.
- M. Division 21 - FIRE SUPPRESSION: Sprinkler heads in ceiling system.
- N. Division 23 - HEATING, VENTILATING AND AIR CONDITIONING: Supply and return air registers.
- O. Division 26 - ELECTRICAL: Independent hangers for suspended lighting fixtures.

1.4 REFERENCES

- A. Referenced Standards: Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. The standards referenced herein are included to establish recognized minimum quality only. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern. Equivalent quality and testing standards will be acceptable, subject to their timely submission, review and acceptance by the Architect.
 - 1. ASTM C 475 - Joint Treatment Materials for Gypsum Wallboard Construction.
 - 2. ASTM C 557 - Standard Specification for Adhesives for Fastening Gypsum Wallboard to Wood Framing.
 - 3. ASTM C 754 - Installation of Steel Framing Members to Receive Screw-Attached Gypsum Board.
 - 4. ASTM C 919 - Use of Sealants in Acoustical Applications.
 - 5. ASTM C 1002 - Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.
 - 6. ASTM C 1047 - Accessories for Gypsum Wallboard and Veneer Base.
 - 7. ASTM C 1396 - Gypsum Wallboard.
 - 8. ASTM D 3678 - Polyvinyl chloride material for indoor exposure.
 - 9. ASTM D 1784 - Polyvinyl chloride material for outdoor exposure.
 - 10. ASTM E 90 - Method of Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions.
 - 11. ASTM E 119 - Fire Tests of Building Construction and Materials.

12. GA 201 - Gypsum Board for Walls and Ceilings.
13. GA 214 - Recommended Specifications for Levels of Gypsum Board Finish, Glass Mat and Fiber-Reinforced Gypsum Panels.
14. GA 216 - Recommended Specifications for the Application and Finishing of Gypsum Board.
15. GA 220 - Recommended Specifications for Gypsum Board Winter Related Job Problems.
16. UL - Fire Resistance Directory.
17. UL 723 - Tests for Surface Burning Characteristics of Building Materials.
18. All applicable federal, state and municipal codes, laws and regulations regarding flammability and smoke generation of interior finishes.

1.5 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. General: Coordinate the work of this Section with the respective trades responsible for installing interfacing and adjoining work for proper sequence of installation, and ensure that the work performed hereunder is acceptable to such trades for the installation of their work.
2. Work of this Section shall be closely coordinated with the work of Section 05 40 00 - COLD-FORMED METAL FRAMING and Section 09 22 16 - NON-STRUCTURAL METAL FRAMING, to assure the steady progress of the Contract.
3. Work of this Section shall be closely coordinated with the work of Section 06 10 00 - ROUGH CARPENTRY, to assure the steady progress of the Contract.

- ##### B. Sequencing: Do not install gypsum board until all pipes, ducts, conduits, and other such items which are to be enclosed thereby, have been permanently installed, inspected and approved.

1.6 SUBMITTALS

A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:

1. Product Data: Manufacturer's product data sheets, specifications, performance data, physical properties for each item furnished hereunder.
2. Shop Drawings:
 - a. Details of any special conditions associated with fireproofing.
 - b. Mark-up a set of blackline interior elevations indicate corrections to grid layout and provide dimensioning showing locations of all proposed control joints and expansion joints.
 - 1) Provide interior elevation drawings for interior elevations which are not included as part of the Contract Drawing set.

1.7 QUALITY ASSURANCE

- ##### A. General: Notify the Architect where conflicts apply between referenced standards and existing materials, and existing methods of construction.

July 11, 2018

- B. Sole Source: Obtain products required for the Work of this Section from a single manufacturer, or from manufacturers recommended by the prime manufacturer of gypsum board.
- C. Qualifications - Installer/Applicator: Minimum of 3 years documented experience demonstrating previously successful work of the type specified herein.

1.8 DELIVERY, STORAGE AND HANDLING

- A. Delivery and Acceptance Requirements:
 - 1. Do not deliver items to the site, until all specified submittals have been submitted to, and approved by, the Architect.
 - 2. Deliver materials in original packages, containers or bundles bearing brand name and identification of manufacturer or supplier.
- B. Storage and Handling Requirements:
 - 1. Store materials inside, under cover and in manner to keep them dry, protected from weather, direct sunlight, surface contamination, corrosion and damage from construction traffic and other causes.
 - a. Neatly stack board materials flat to prevent sagging.
 - 2. Handle board materials so to prevent damage to edges, ends and surfaces.
 - 3. Protect trim, accessories and corner beads from being bent or damaged.

1.9 SITE CONDITIONS

- A. Environmental Conditions: In accordance with GA 216, maintain minimum ambient temperature of 50 degrees Fahrenheit 48 hours before, during taping and compounding, and until completely dry thereafter.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
 - 1. Gypsum board products:
 - a. United States Gypsum Company, Chicago IL. (USG).
 - b. National Gypsum Company, Gold Bond Products Division, Charlotte NC. (Gold Bond).
 - c. G-P Gypsum Corporation, Atlanta GA.
 - d. Continental Building Products, Hendron VA.
 - 2. Polyvinyl chloride trim and accessories:
 - a. Plastic Components, Inc., Miami FL.
 - b. Trim-Tex Drywall Products, Lincolnwood IL.
 - c. Vinyl Corporation, Miami FL.
 - d. Alabama Metal Industries Corporation, (AMICO)Birmingham, AL.
 - 3. Joint sealants:

- a. Tremco, Beachwood OH.
 - b. United States Gypsum Company, Chicago IL.
 - c. Pecora Corporation, Harleysville PA.
- B. The design and details as shown on the Drawings and the model numbers specified herein are to establish the standards of design and quality and not to limit competition.

2.2 DESCRIPTION

A. Regulatory Requirements

- 1. Obtain certificate of compliance from authority having jurisdiction indicating approval of specified products.
- 2. Fire resistance ratings: Where gypsum board systems with fire-resistance ratings are indicated, provide materials and assemblies of the rating required, tested per ASTM E 119, which are identical to those indicated by reference to Gypsum Association file numbers in "Fire Resistance Design Manual" or to design designation in the Underwriters Laboratories "Fire Resistance Directory" or in listing of other testing agencies acceptable to authorities having jurisdiction and to the Owners' insurance underwriters.
- 3. Seismic Compliance: Nonstructural components that are permanently attached to structures and their support attachments, shall be designed and constructed to resist the effects of earthquake motions in accordance to local jurisdiction.

2.3 BOARD MATERIALS

- A. Non-rated and Fire rated gypsum board (for wall fire resistant ratings 120 minutes and less): UL fire resistance rated, ASTM C 1396 'Type X' board, 5/8 inch thick, 48 inch width, of lengths to minimize end joints, with tapered edges.
- 1. Acceptable products include the following, or approved equal:
 - a. USG Sheetrock brand "Firecode Core"
 - b. National Gypsum Company, Gold Bond brand product "Fireshield Gypsum Board".
 - c. G-P Gypsum Corporation product, "ToughRock Fireguard".
 - d. Continental Building Products, product "Firecheck Type X".
- B. Sag-resistant gypsum board ceiling panels: Non-rated 1/2 inch thick, 48 inch width, of lengths to minimize end joints, with tapered edges, conforming to ASTM C 1396.
- 1. Acceptable products include the following or approved equal:
 - a. USG Sheetrock brand product "Interior Ceiling Panel, Sag Resistant".
 - b. National Gypsum Company, Gold Bond brand product "High Strength Ceiling Board".
 - c. G-P Gypsum Corporation product, "ToughRock CD Ceiling Board".
 - d. Continental Building Products, product "Sagcheck".
 - 2. At fire-resistant rated ceilings, provide 5/8 inch thick fire-rated gypsum board as specified herein.

July 11, 2018

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- C. Mold and moisture resistant (MR) gypsum board, fire resistant: water-resistant, mold-resistant interior wall panel; conforming to ASTM C630 and C1396 (Section 5), with Type "X" core 5/8 inch thick, 48 inch width, of lengths to minimize end joints, with tapered edges.
1. Glass-matt- faced acceptable products include the following or approved equal:
 - a. Georgia-Pacific Gypsum, LLC, product, "DensArmor Plus Paperless Interior Panel.
 - b. National Gypsum Company, Gold Bond brand product "eXP Interior Extreme Gypsum Panel."
 - c. Continental Building Products, product "Weather Defense Platinum Interior, Type X".

2.4 TRIM AND EDGE COMPONENTS

- A. Polyvinyl chloride (PVC) trim accessories, conforming to ASTM D 1784 and C 1047.
1. J Bead: Edge trim with exposed 1/2 inch face cap, furnish trim model number corresponding to the board thickness where installed.
 - a. Plastic Components model number: 200X-50 (for 1/2 inch thick board) or 200S-58 (for 5/8 inch thick board).
 - b. Trim-Tex, model: 1110 (for 1/2 inch thick board) or 1210 (for 5/8 inch thick board).
 - c. Vinyl Corp. model number: JB50 (for 1/2 inch thick board) or JB58 (for 5/8 inch thick board).
 - d. AMICO. model number: AMJB50 (for 1/2" thick board) or AMJB58 (for 5/8" thick board).
 2. L Bead: casing edge trim, furnish trim model number corresponding to the board thickness where installed
 - a. Plastic Components model number: 221-50 (for 1/2 inch thick board) or 221-58 (for 5/8 inch thick board).
 - b. Trim-Tex, model: 1710 (for 1/2 inch thick board) or 1810 (for 5/8 inch thick board).
 - c. Vinyl Corp. model number: SB50 (for 1/2 inch thick board) or SB58 (for 5/8 inch thick board).
 - d. AMICO. model number: AMSB50 (for 1/2 inch thick board) or AMSB58 (for 5/8 inch thick board).
 3. Corner beads, 90 degree with minimum 1-1/4 inch flanges:
 - a. Plastic Components model number: 209.
 - b. Trim-Tex model: 4010
 - c. Vinyl Corp. model number: CB125.
 - d. AMICO. model number: AMCB125.
 4. Control joints: "V" type joint with nominal 3/16 inch reveal and removable temporary tape:
 - a. Gold bond model "EZ Strip Expansion Joint".

- b. Plastic Components model number: 2027-16.
- c. Trim-Tex model: 093V
- d. Vinyl Corp. model number: CJV16.
- e. AMICO. model number: AMDCJV16.

2.5 ACCESSORIES

A. Tapes and compound:

- 1. Joint tape (at paper-faced gypsum): Nominal 2 inch wide, high strength, cross-fibred paper drywall tape.
- 2. Joint tape (at fiberglass faced gypsum): Nominal 2 inch wide, self adhering (adhesive backed), fiberglass mesh tape.
- 3. Joint Compound for setting fiberglass joint tape:
 - a. Cetainteed, Valley Forge PA., product "ProRock Moisture and Mold Resistant 90".
 - b. Georgia Pacific Gypsum LCC., Pittsburgh PA, product "Densarmor Cote"
 - c. CTS Cement Manufacturing Corporation, Cypress CA., product "Rapid Set OnePass".
- 4. Joint Compound for setting paper joint tape: 'Speed-setting type compound', field mixed.
 - a. Acceptable products, or approved equal:
 - 1) USG product "Durabond 20".
 - 2) Gold bond product "Stay Smooth 30".
 - 3) Georgia Pacific Gypsum LCC, product "ToughRock All-Purpose Dry Mix"
- 5. Joint Compound for finishing: field mixed joint compound or factory pre-mixed compound.
 - a. Field-mixed compounds: acceptable products, or approved equal:
 - 1) USG product "Durabond 90".
 - 2) Gold bond product "Stay Smooth 90".
 - 3) Georgia Pacific Gypsum LCC, product "ToughRock Setting Compound 90".
 - b. Factory pre-mixed compounds: acceptable products, or approved equal:
 - 1) USG product "Ready-Mixed Joint Compound".
 - 2) Gold bond product "All Purpose Compound".
 - 3) Georgia Pacific Gypsum LCC, product "ToughRock Ready Mix All-Purpose Compound"

B. Fasteners (interior board systems):

- 1. Type S, bugle head screws complying with ASTM C 1002, for applying gypsum board to metal framing, ceiling grid system, and furring channels.
 - a. Not less than 1 inch long for single layer gypsum board.
 - b. Not less than 1-5/8 inch [41mm] long for double-layer gypsum board.
- 2. Type W, bugle head screws complying with ASTM C 1002, for applying gypsum board to wood framing and furring.

- a. Not less than 1-1/4 inch [31mm] long for single layer gypsum board
 - b. Not less than 1-5/8 inch [41mm] long for double-layer gypsum board,
- C. Ceiling buttons, perforated type, 1 inch diameter, for use at multiple layered gypsum board ceiling systems.
- D. Laminating adhesive: Ready mix joint compounds as specified herein above.
- E. Joint Sealers (Acoustical Sealant): One component acrylic latex, permanently elastic, non-staining, non-shrinking, non-migrating and paintable. Acceptable products include the following, or approved equal.
- 1. Tremco, Beachwood OH.; product, "Acoustical Sealant".
 - 2. United States Gypsum Company, Chicago IL.; product "USG Acoustical Sealant".
 - 3. Pecora Corporation, Harleysville PA.; product "AC-20 FTR".
- F. Liquid sealer for cuts, holes and ends of moisture resistant board; provide one of the following or acceptable equal.
- 1. Shellac type sealer: mix 4 pounds of orange or bleached shellac dissolved in 1 gallon of denatured ethyl-alcohol.
 - 2. Varnish type sealer: Fast setting marine varnish.

2.6 SOURCE QUALITY CONTROL

- A. Obtain gypsum board and finishing products from a single manufacturer, or from manufacturers recommended by the prime manufacturer of gypsum boards.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that all items which are to be enclosed by Work of this Section, have been permanently installed, inspected and approved.
- B. Inspect framing and other substrates; verify that they are in proper condition to receive the work of this Section.
- C. Beginning of installation means acceptance of existing substrate and site conditions.

3.2 PREPARATION

- A. During the operation of gypsum board work, protect all wood, metal, glass, flooring, and other finished materials against undue soilage and damage by the exercise of reasonable care and precautions. Repair or replace any work so damaged and soiled.

3.3 INSTALLATION - GENERAL

- A. General: Perform erection procedures for the various gypsum board system conditions, except as otherwise specified, as set forth in GA 201, GA 216, GA 220, the written instructions of gypsum board manufacturer, together with the additional requirements specified herein and as indicated on the Drawings.

July 11, 2018

- B. Where fire-resistive rated assemblies are indicated, erect gypsum board systems in strict accordance with the manufacturers' UL listed test constructions for the required fire rating on each specific assembly.
- C. Install specified control joints where indicated on Drawings and where run of partitions, or furred surfaces exceeds 30 feet. Show locations of all control joints on shop drawings.
 - 1. Locate control joints at corners of head frames of doors.
 - 2. Run vertical control joints continuously to top of partition, shaft wall or furred area, as applicable.

3.4 INSTALLATION OF GYPSUM BOARD

- A. Screw fasten only, gypsum board to framing and furring, with ends and edges occurring over firm bearing. At all door jambs screw fasten gypsum panels 8 inches on center to both box studs
 - 1. Erect single layer fire-resistance rated gypsum board vertically.
 - 2. Erect standard and moisture resistant layer board in most economical direction.
 - 3. Erect ceiling and soffit gypsum boards to meet UL requirements, where applicable, stagger end joints over supports. Secure gypsum board with fasteners inserted through ceiling buttons; anchor fasteners directly to framing or suspended support system.
- B. Wherever items penetrate the gypsum board surfaces, use extra care in cutting the gypsum board to ensure a uniformly-dimensioned joint between the penetrating item and the gypsum board, and fill joints with specified sealant material. Verify the expected deflection factor of the penetrating members, and cut the gypsum accordingly, to prevent damage thereto from the deflecting members.
- C. Treat cut edges and holes in moisture resistant gypsum board with approved liquid sealer.
 - 1. If shellac is used, apply in thin layers to dry quickly.
- D. Installing Trim Accessories:
 - 1. General: For trim with back flanges intended for fasteners, attach to framing with same screw fasteners used for gypsum board. Otherwise, attach trim according to manufacturer's written instructions.
 - a. Nailing, stapling, or crimping methods to install trim components is prohibited.
 - 2. Install corner beads at all exterior corners of gypsum boards.
 - 3. Install casings (PVC trim) wherever gypsum board meets a dissimilar material, and in other locations indicated on the Drawings, except at floors where bottom of the board will be concealed by base, integral with flooring, resilient base, wood base or carpeted base.

3.5 PATCHING EXISTING GYPSUM WALLBOARD

- A. Patch existing gypsum wallboard surfaces disturbed by new construction.

July 11, 2018

- B. All patching material shall be flush with, and match, existing surfaces to be patched.
- C. Install metal framing necessary for the support of new wallboard.
- D. Finish new wallboard as specified. Finish shall match surrounding surfaces for texture.

3.6 APPLICATION OF ACOUSTICAL SEALANT

- A. General: Install sealant and backing in accordance with the recommendations of ASTM C-919 and sealant manufacturer's recommendations.
 - 1. Perform preparation in accordance with C-790. Thoroughly clean all joints, removing all loose mortar, oil, grease, dust, frost, and other foreign materials that will prevent proper adhesion of primers and sealant materials.
 - 2. If so recommended and furnished by the specific sealant manufacturer, apply primer to all joint surfaces, taking care not to stain adjacent surfaces.
- B. Seal all partition perimeters prior to taping or compounding. Where perimeters are edged with metal trim, apply sealant and backing material between trim and dissimilar material.
- C. Seal all penetrations in partition types designated for "acoustical" insulation. Penetrations to receive sealant include electrical boxes, plumbing, heating and air conditioning ducts, telephone, intercom hookups and similar items.
 - 1. Install joint bead back-up in all joints in excess of 5/8-inch depth, and joints that have no back-up therein, placing the joint bead in the joint in a manner that will assure a constant depth 1/8 inch greater than the sealant and caulking material depth tolerances.
 - a. Set beads into joints continuously, by slightly stretching during placement, to permit compression against sides of joint, without surface wrinkles or buckles.
 - b. Do not stretch back-up material into joints.
 - c. Install bond breaker wherever recommended by the sealant manufacturer to prevent bond of the sealant to surfaces where such bond might impair the Work.
 - 2. Apply sealant in continuous beads without open joints, voids or air pockets
 - a. The depth of sealant and caulking materials shall be in accordance with manufacturer's recommendations for the specific joint function, but in no case exceed 1/2-inch in depth, nor less than 1/4-inch, regardless of the joint width.
 - 3. Remove the temporary masking tape immediately after tooling, and before the sealant or caulking material has taken initial set.

3.7 APPLICATION OF JOINT TREATMENT

- A. Install joint tape at all joints where gypsum boards abut and where boards form internal corners, whether or not such joints will be concealed from view.
- B. Apply compound to all joints, edges, corners, fastener head depressions and abrasions in the surfaces, whether or not such conditions will be concealed from

view. Sand completely smooth all compound surfaces, which will be exposed to view, and leave ready to receive applied coatings or finish.

- C. Provide the minimum levels of gypsum board finishes as defined by the Gypsum Association recommended specifications GA-214 and GA-216, per the following:
 - 1. At areas hidden from view, except as otherwise specified: Level 1.
 - 2. At areas hidden from view, requiring a fire rating: Level 1.
 - 3. At surfaces scheduled to receive applied wood wall paneling (Bead-board): Level 2.
 - 4. At surfaces scheduled to receive painted finishes: Level 4, except at each of the following conditions, provide Level 5 finish:
 - a. Wall surfaces that are lit with raking light or washed with lights.
 - b. Locations noted on Drawings.

3.8 TOLERANCES

- A. Maximum variation for gypsum board partitions and ceilings from true flatness: 1/8 inch per 10 feet, noncumulative.

3.9 CLEANING

- A. Daily clean work areas by sweeping and disposing of debris, scraps, and deposits of compound and gypsum fill.
- B. After completion of the work of this Section, remove equipment, and clean all wall, partition, and floor areas free from deposits of gypsum fill, and other materials installed under this Section.

End of Section

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Section 09 30 00
TILING

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish and install the following:
 - 1. Interior floor and wall tile.
 - 2. Tile base and associated trim.
 - 3. Stone thresholds and saddles.
 - 4. Fluid applied waterproofing membrane at wet floor areas occurring over occupied spaces and where additionally indicated.
 - 5. Cementitious tile backer board.
 - 6. Installation systems, adhesives, mortars and grouts.
 - 7. Control joints in tiled floors.
- B. Install the following furnished under the designated Sections:
 - 1. Install access panels into tiled walls as specified under Section 08 31 00 - ACCESS DOORS AND PANELS.
- C. Perform drilling and cutting in tile surfaces, as required to accommodate penetrating items of other trades, from templates and instructions furnished by the respective trades.

1.2 RELATED REQUIREMENTS

- A. Section 06 10 00 - ROUGH CARPENTRY: Wood blocking, base backing, subfloor and underlayment.
- B. Section 07 92 00 - JOINT SEALANTS: Backer rod and sealant at control joints.
- C. Section 08 31 00 - ACCESS DOORS AND PANELS, and by trades requiring the same: access panels, occurring in partitions and walls.
- D. Section 09 05 60 - COMMON WORK RESULTS FOR FLOORING: General requirements for flooring preparation, substrate testing requirements, installation and temporary protection, for the work of this Section 09 30 00.
- E. Section 10 28 13 - TOILET ACCESSORIES: Furnishing toilet accessories and installation templates.

1.3 REFERENCES

- A. Referenced Standards: Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
 - 1. ANSI A108.5 - Installation of Ceramic Tile with Dry-Set Portland Cement Mortar or Latex Portland Cement Mortar.
 - 2. ANSI A108.10 - Installation of Grout in Tilework.

July 11, 2018

3. ANSI A108.11 - Interior Installation of Cementitious Backer Units.
 4. ANSI A118.4 - Latex-Portland Cement Mortar.
 5. ANSI A118.6 - Ceramic Tile Grouts.
 6. ANSI A118.7 – Polymer Modified Cement Grouts
 7. ANSI A118.9 - Cementitious Backer Units.
 8. ANSI A118.10 - Waterproofing.
 9. ANSI A137.1 - Specifications for Ceramic Tile.
 10. ANSI A10.20 - Safety Requirements for Ceramic Tile, Terrazzo and Marble Work.
 11. ASTM C 627 - Evaluating Ceramic Floor Tile Installation Systems.
 12. ASTM E 119 – Fire Test of Building Construction and Materials.
- B. Inclusionary References: The following reference materials are hereby made a part of this Section by reference thereto:
1. TCNA (formerly TCA) - Handbook for Ceramic Tile Installation, latest edition.
- C. Definitions: For the purposes of these specifications the following terms are defined:
1. Wet Areas: Rooms/spaces which has plumbing fixtures, sinks, toilets, or floor drains. Wet areas additionally include rooms/spaces which are exposed to weather.
 2. Dry Areas: Rooms/spaces which have no plumbing, sinks, toilets, or floor drains.

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Pre-installation Meetings: Installer of the Work of this Section is required to attend pre-installation conference specified under Section 09 05 60 - COMMON WORK RESULTS FOR FLOORING.
- B. Coordination:
1. Coordinate the work of this Section with the respective trades responsible for installing interfacing work, and ensure that the work performed hereunder is acceptable to such trades for the installation of their work.

1.5 SUBMITTALS

- A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
1. Product Data: Manufacturer's product data sheets, specifications, performance data, physical properties and installation instructions for each item furnished hereunder.
 - a. Include maintenance data and recommended cleaning materials, and cleaning and stain removal methods.
 2. Shop Drawings: 1/4 inch scale elevations and plans of tile patterns.
 3. Selection Samples:

- a. Manufacturer's sample boards for each type and color group of tile specified, and grout colors, for selections by the Architect.
- 4. Verification Samples:
 - a. Mount tile and apply grout on one 24 by 24 inch cement backerboard board, for each tile type and selected color, to indicate color and texture variations, tile flatness and joint size variations.
 - b. Trim shapes and base, in selected colors in types and shapes indicated for project conditions.
 - c. Stone threshold, 12 inch long samples in shaped profile.
- 5. Source Quality Control Submittals:
 - a. Grade Certificates: Manufacturer's Master Grade Certificates submitted prior to shipment of tile to project.
- B. Maintenance Material Submittals: Submit the following under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS. Clearly label and package extra materials securely to prevent damage.
 - 1. Extra Stock Materials: Upon completion of the Work of this Section, deliver to the Owner extra materials in, an amount equal to 3 percent of tile and trim of each color, finish and type installed.

1.6 QUALITY ASSURANCE

- A. General: Notify the Architect where conflicts apply between referenced standards and existing materials, and existing methods of construction.
 - 1. Conform to ANSI/TCNA A 137.1 and TCNA Handbook for Ceramic Tile Installation.
 - 2. Tiles delivered to the job or installed in the work which do not fall within the accepted color and texture range demonstrated by the samples shall be removed from the site and replace with acceptable materials.
- B. Sole Source: Obtain installation products required for the Work of this Section from a single manufacturer.
- C. Qualifications:
 - 1. Installer/Applicator: Minimum of 3 years documented experience demonstrating previously successful work of the type specified herein.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Delivery and Acceptance Requirements:
 - 1. Do not deliver items to the site, until all specified submittals have been submitted to, and approved by, the Architect.
 - 2. Deliver tile in manufacturer's sealed cartons, grade-sealed by the manufacturer in accordance with ANSI A 137.1, with grade-sealed unbroken, and clearly marked as to contents, color, and quantity.
 - 3. Deliver and store tile setting materials in original, sealed, containers showing manufacturer's identification, year of production, new weight, date of packaging, and location of packaging.

July 11, 2018

- B. Storage and Handling Requirements:
 - 1. Store and handle materials following manufacturer's recommended procedures, and in accordance with material safety data sheets.
 - 2. Store and protect containers above floor level, keep dry until ready for use.
 - 3. Protect adhesives from freezing or overheating in accordance with manufacturer's instructions.

1.8 SITE CONDITIONS

- A. Environmental conditions:
 - 1. General: Maintain ambient temperatures between 50 (10° C) and 80 (26° C) degrees Fahrenheit in tiled areas, for 24 hours prior to installation, during installation and for 7 days after completion.
 - 2. When temperature of substrate exceeds 90 (32° C) degrees Fahrenheit, contact manufacturer for instructions.
- B. Do not install setting or grouting materials in a closed, unventilated environment. Ventilate propane or fossil fuel heaters to prevent damage to tile work from carbon-dioxide build up.

1.9 WARRANTY

- A. General: Submit warranties under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS.
- B. Manufacturer Warranty: The manufacturer of installation systems, adhesives, grouts and mortars shall provide a comprehensive non pro-rated written five (5) year warrantee against defective products which covers replacement materials and labor costs for demolition, tile accessories, and installation systems.
 - 1. Warranty to provide for tile lifting or separation from substrate, and setting bed/grout deterioration, when products have been installed with referenced TCNA setting systems using specified setting and grout materials.
 - 2. Warranty excludes structural failure, movement or cracking of substrate materials, and workmanship performed not in accordance with manufacturer's instructions and industry standard guidelines.
- C. Special Warranty: Provide 2 year, non pro-rated warranty which shall include provisions for cracking, breakage or failure of tile due to defective workmanship
 - 1. Materials must be compatible and from one source, single source responsibility for waterproofing, installation, mortars and grouts. Job-site mixtures of sand portland cement and site dilution of additives shall not be permitted.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Specified Manufacturer: To establish a standard of quality, design and function desired, Drawings and specifications have been based on the products and materials specified in the following Articles.
 - 1. Tile: As scheduled on Drawings.

July 11, 2018

2. Cementitious tile backer board ("Cement board"):
 - a. Custom Building Products, Inc., Seal Beach, CA.
 - b. Fin Pan, Inc., Hamilton OH.
 - c. Unifix, Inc., division of National Gypsum Company, Charlotte, NC.
 - d. United States Gypsum Company, Chicago, IL.
3. Edging materials:
 - a. Schlüter Systems L.P., Plattsburgh NY.
 - b. Custom Building Products, Inc., Seal Beach, CA.
 - c. Ceramic Tool Company Inc., Waukesha WI.

2.2 STONE THRESHOLDS

- A. Where indicated on the Drawings, provide marble thresholds complying with Class "A" of the Marble Institute of America, in color selected by the Architect from standard colors of the approved fabricator, shaped to provide a comfortable transition between tile and other floor finishes, with smooth matte surface finish and in the dimensions and thickness shown on the Drawings.

2.3 SETTING MATERIALS

- A. Thin-set polymer-modified Portland cement dry-set mortar, complying with the bond strength requirements of ANSI A118.4.
 1. Acceptable products are limited to:
 - a. Mapei product: "Kerabond" with "Keralastic" additive.
 - b. Laticrete product number 254 Platinum, with antimicrobial additive.
 - c. Custom Building Products "Porcelain Tile Mortar"
- B. Mortar bed (factory pre-mixed) for thick-set applications: Acceptable products are limited to:
 1. Mapei product: "3 to-1" with "Planicrete 50" additive.
 2. Laticrete product number "3701 Fortified Mortar Bed".
 3. Custom Building Products "Fast Setting Thick Bed Mortar"
- C. Slurry mix bond coat for thick-set applications: Portland cement, silica sand and latex admix in proportions recommended by additive manufacturer.
 1. Portland cement/sand mix: Laticrete product number 211, "Crete Filler Powder" or the field mix the following:
 - a. Portland Cement: Conforming to ASTM C 150, Type 1.
 - b. Sand: Fine silica sand (40 to 60).
 2. Latex additive: Acceptable products are limited to:
 - a. Mapei product: "Planicrete 50".
 - b. Laticrete product number 4237.
 - c. Custom Building Products "Custom Crete"
- D. Fluid applied waterproofing membrane: ASTM C627 classification "Extra Heavy". Two component liquid rubber membrane cold applied, load bearing, bonded, non-

toxic, non-flammable, and non-hazardous, used with 20 mil (0.5mm) thick flexible nonwoven rot-proof polyvinyl chloride reinforcing fabric.

1. Waterproofing membrane shall be IAPMO certified as shower pan liner under the International Plumbing Code.
 2. Waterproofing membrane shall provide crack suppression and isolation for anti-fracture per ANSI A118.12.5.4, spanning 1/8 inch (3mm) crack, and meet the following physical requirements:
 - a. Water Permeability (at 30ft.hydro/0.9 atmos/91.2kPa): Nil.
 - b. Elongation at break (ASTM D-751): 20 to 30%
 - c. Service Temperatures: -20° to +280°F. (-29°to +138°C).
 - d. Tensile breaking strength: 2950psi (20.4MPa;207kg/cm²)
 - e. Bond strength to concrete: 350psi (2.4MPa;24kg/cm²)
 - f. Resistance to chemicals (90 day immersion):
 - 1) Brine solution Not Affected.
 - 2) Sugar solution Not Affected.
 - 3) Milk Not Affected.
 - 4) 10% Citric Acid Not Affected.
 - 5) 3.5 percent HCl Acid: Not affected.
 - 6) 5% Acetic Acid: Not Affected
 - 7) 1% Alkali solution: Not Affected
 - 8) Urine: Not Affected
 - 9) Calcium chloride: Not Affected.
 - 10) Toluol Softens.
 - g. Floor Tile Installation Evaluation (ASTM C627-81) 900 cycles
 - h. Service Rating (TCNA) Extra Heavy Duty
- E. Cementitious tile backer board ("cement board"): 1/2-inch nominal thickness, glass fiber reinforced, with a minimum compressive strength of 1,250 pounds per square inch and minimum flexural strength of 750 pounds per square inch.
1. Acceptable products include the following:
 - a. Custom Building Products, Inc. product "WonderBoard Lite" (7/16 inch thickness)
 - b. Fin Pan, Inc., product: "Util-a-Crete".
 - c. National Gypsum Company, Charlotte, NC. product "PermaBase".

2.4 GROUTING MATERIALS

- A. Grout for walls having joints less than 1/8 inch width: Acrylic modified Portland cement (unsanded) grout conforming to ANSI 118.6. Acceptable products are :
1. Mapei product: "Ker-800" with acrylic latex additive "Plastijoints",
 2. Laticrete product "Laticrete 1600 Series (unsanded) with admix 1776 antimicrobial.
 3. Custom Building Products PolyBlend unsanded grouts.
- B. Grout for floors, and walls having joints 1/8 inch and greater width: Acrylic modified Portland cement sanded grout conforming to ANSI 118.6. Acceptable products are:

1. Mapei product: "Ultracolor" with acrylic latex additive "Plastijoints",
2. Laticrete product "Laticrete 1500 Series (sanded) with admix 1776 antimicrobial.
3. Custom Building Products PolyBlend sanded grouts.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Inspect all surfaces and verify that they are in proper condition to receive the work of this Section.
 1. Verify that all concrete substrates are at least 28 calendar days old, completely cured and free of negative hydrostatic conditions or moisture problems.
- B. Preinstallation Testing, Evaluation and Assessment: Moisture testing of concrete substrate, refer to Specification Section 09 05 60 – COMMON WORK RESULTS FOR FLOORING.
 1. Beginning of installation means acceptance of existing substrate and site conditions.

3.2 PREPARATION

- A. General: Comply with requirements specified under Section 09 05 60 – COMMON WORK RESULTS FOR FLOORING, the flooring manufacturer's requirements for preparation of substrate to receive resilient flooring, and as additionally specified herein.
- B. Ensure that all anchors, plugs, electrical and mechanical work to be in or underneath tile have been installed.
- C. Vacuum clean substrate surfaces.
- D. Seal concrete substrate cracks with filler; level concrete substrate to acceptable flatness tolerances.
 1. The use of PVA bonding agents or gypsum based leveling materials is prohibited.
- E. Apply conditioner or primer to surfaces as recommended by adhesive manufacturer.

3.3 INSTALLATION - GENERAL REQUIREMENTS

- A. Installation Standards: The American National Standard Specifications for the Installation of Ceramic Tile, 1992 edition (ANSI A108), is hereby made a part of this specification. All work of this Section shall be installed in accordance with the requirements contained in referenced ANSI A108 standards, and as additionally specified below, and in accordance with the manufacturer's specifications of those products used.
- B. Installation Methods: Schedule of substrate conditions, generic type of tile used, with appropriate setting and grouting methods are listed at end of this Section.

1. Use trowel shapes and sizes as recommended by setting materials manufacturer.
 2. Back-butter tiles as required to provide coverage indicated, except for tiles exceeding 144 square inches which require a complete back application of mortar (100% coverage).
- C. Tile Patterns and types: Tile patterns are shown on the Drawings, if more information is required, obtain the necessary information from the Architect. Do not interrupt tile pattern around openings.
- D. Tile Layout and installation
1. Layout tile on room axis, leaving equal sized border units of not less than one-half tile width.
 2. Cut and fit tile tight to penetrations through tile. Form corners and bases neatly. Align base and wall joints.
 3. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make joints watertight, full without voids, cracks, excess mortar, or excess grout.
 4. Do not align joints of base units and lowest course of tile, offset joints by one-half of unit width.

3.4 INSTALLATION OF CEMENT BOARD

- A. Walls:
1. Wall framing substrate: Do not install cement board directly over protrusions from stud plane such as heavy brackets or fastener heads.
 2. Make necessary cut-outs. Install cement board horizontally leaving 1/8 to 3/16 space at all joints, including joints with dissimilar materials. Stagger board joints with those of adjacent rows.
 3. Fasten cement board with 1-1/4 inch length type S bugle head screw. Fasten boards every 8 inches on center in field and along edges. At edge conditions, locate fasteners between 1/2 inch to 2 inches from board edge.
 4. At all joints and corners, fill gap solidly with dry-set or latex-modified, portland cement mortar and imbed 2 inch mesh fiberglass table and smooth material over joint and corner.
- B. Floors:
1. Laminate cement board to plywood or oriented strand board (OSB) subfloor using adhesive or ANSI A118.11 mortar suitable for bonding cement backer board to the subfloor. Apply adhesive with 5/8 V-notched trowel, mortar with 1/4 square-notched trowel.
 2. Place underlayment with joints staggered from subfloor joints. Fit ends and edges closely but not forced together, leaving a 1/8 gap. Fasten underlayment to subfloor with 1-1/2 hot-dipped galvanized roofing nails or 1-1/4 inch length stainless steel wood screws spaced 8 inches on center in both directions.
 3. Prefill joints, as well as inside and outside corners, with latex-fortified mortar and immediately embed tape and level joints.

July 11, 2018

3.5 INSTALLATION OF CONTROL JOINTS

- A. General: Provide control joints where indicated on the Drawings, and as directed by the Architect. Where not indicated, provide joints per the following requirements in specific locations approved by Architect:
 - 1. Interior tilework: 24 to 36 feet in each direction, except where exposed to direct sunlight or moisture.
 - 2. Interior tilework exposed to direct sunlight or moisture: 12 to 16 feet in each direction.
 - 3. Where tile abuts restraining surfaces such as perimeter walls, dissimilar floors, curbs, columns, pipes, and where changes occur in substrate materials.
 - 4. At perimeter walls in rooms and spaces larger than 12 feet on one side.
 - 5. As continuation of expansion joints, control joints, and seismic joints in the building structure which occur in tile areas.
- B. Locations: Verify exact locations of joints with Architect prior to commencing tile installation.
- C. Control joints:
 - 1. Form control joints neat, straight, and uniformly wide equal to width of normal tile joint. Cut tile neatly and to accurate radius at exposed junction with pipes.
 - 2. Extend control joints full thickness of tile, setting bed and reinforcing.
- D. Keep open joints free of grout and debris until filled with sealant. Install non-contaminating temporary joint filler to maintain joints in clean condition until installation of joint backing and sealant under Section 07900 - JOINT SEALERS.

3.6 FLOORING INSTALLATION – TCNA NUMBER F111 (MODIFIED)

- A. Description: Thin-set tile installation over tapered or level thick (mud) set tile base.
- B. General: Install in accordance with ANSI A108.1B, TCNA installation method number F111, and as additionally specified herein below. Apply materials in strict accordance with the written instructions and recommendations of setting materials manufacturer.
 - 1. Setting materials:
 - a. Anti fracture membrane (Fluid applied waterproofing membrane).
 - b. Primer Coat: Slurry bonding coat
 - c. Portland cement mortar bed.
 - d. Thin-Set Bond Coat: latex modified Portland cement mortar (ANSI A118.4).
 - 2. Grout materials: acrylic modified Portland cement sanded grout (ANSI A118.6).
- C. Install anti-fracture / waterproofing membrane over 100% of tile substrate area.
- D. Apply a slurry bond coat as recommended by manufacturer to ensure adhesion of mortar bed with substrate.

- E. Install portland cement mortar leveling bed to a nominal thickness of 1 inch, or level with other substrates scheduled to receive tile. Screed finish surface.
- F. Allow leveling bed to cure for not less than 7 days prior to installation of tile.
- G. Apply latex modified Portland cement bond coat.
- H. Grouting:
 - 1. Allow tile to fully set prior to grouting; do not grout in less than 24 hours after installation of tile.
 - 2. Grout tile joints in accordance with ANSI A108.10 and as additionally specified.

3.7 FLOORING INSTALLATION – TCNA NUMBERS F122 / F122A (MODIFIED)

- A. Description: Thin-set tile installation with reinforced waterproofing membrane, at “wet areas.”
- B. General: Install in accordance with ANSI A108.5, and TCNA installation method number F122A, and as additionally specified herein below. Apply materials in strict accordance with the written instructions and recommendations of setting materials manufacturer.
 - 1. Setting materials:
 - a. Membrane: Reinforced waterproofing membrane.
 - b. Bonding coat: Latex modified portland cement (ANSI A118.4).
 - 2. Grout materials: Acrylic modified Portland cement sanded grout (ANSI A118.6).
- C. Install liquid applied waterproofing membrane with reinforcing over entire tile substrate area in strict compliance with manufacturer’s written instructions. (TCNA F125-Full).
- D. Install latex/portland cement mortar bed over cured waterproofing membrane to a nominal thickness of 3/32 inch.
- E. Grouting:
 - 1. Allow tile to fully set prior to grouting; do not grout in less than 48 hours after installation of tile.
 - 2. Grout tile joints in accordance with ANSI A108.10 and as additionally specified.

3.8 WALL TILE INSTALLATION - TCNA NUMBER W244F

- A. General: Install in accordance with ANSI A108.5, TCNA installation method number W244F, and as additionally specified herein below. Apply materials in strict accordance with the written instructions and recommendations of setting materials manufacturer.
 - 1. Setting materials: Latex modified Portland cement (ANSI A118.4).
 - 2. Grout materials: Acrylic modified Portland cement (unsanded) grout (ANSI A118.6).

July 11, 2018

- B. Install latex modified Portland cement mortar bed to a thickness recommended by manufacturer.
- C. Grouting:
 - 1. Allow tile to fully set prior to grouting; do not grout in less than 24 hours after installation of tile.
 - 2. Grout tile joints in accordance with ANSI A108.10 and as additionally specified.

3.9 INSTALLATION - GROUT

- A. Remove spacers, ropes, glue, and similar foreign matter prior to grouting.
- B. Force the maximum amount of the approved grout into joints in accordance with pertinent recommendations contained in ANSI A108.10 and for epoxy grouts, ANSI A108.6.
- C. Fill in joints of cushion-edge tile to depth of the cushion; fill joints of square-edge tile flush with the surface.
- D. Fill all gaps and skips. Do not permit mortar or mounting mesh to show through grouted joints.
- E. Provide hard finished grout which is uniform in color, smooth and without voids, pin holes, or low spots.
- F. Remove all excess grout immediately after installation thereof, wash and rinse tile free from grout film, and tool grout to a uniform density throughout.

3.10 REPAIR

- A. Replace cracked chipped, broken, and otherwise defective tiles.
- B. Remove work not complying with requirements of the Contract Documents or the referenced standards, and promptly replace with work which does comply.

3.11 CLEANING

- A. General: Comply with requirements of Section 01 73 00 – EXECUTION for periodic and final cleaning, and as additionally specified herein.
 - 1. Control accumulation of waste materials and trash. Daily clean work areas by sweeping and disposing of debris, and scraps.
- B. After completion of the work of this Section, remove equipment, and clean all wall, partition, and floor areas free from deposits of mortar, grout, and other materials installed under this Section, and wash completed tilework.
 - 1. Do not use acid or acid cleaners to clean tile.
 - 2. When tile is thoroughly clean and dry, polish glazed tile with clean dry cloths.

3.12 CURING

- A. Cover with clean non-staining 40 pound kraft paper. Do not use polyethylene sheets directly over tile on horizontal surfaces.

July 11, 2018

POPE'S TAVERN
ADDITION/RENOVATION
Halifax, Massachusetts

3.13 PROTECTION

- A. General: Protect finished work under provisions Section 09 05 60 – COMMON WORK RESULTS FOR FLOORING.
- B. Do not permit traffic over finished floor surface until grout and tile materials are fully set, and not less than 72 hours. Protect floor surfaces with heavy red-rosin paper or kraft paper.

End of Section

TILING

09 30 00 - page 12 of 12

Section 09 64 29
WOOD STRIP FLOORING

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. The BIDDING REQUIREMENTS, CONTRACT FORMS, and CONTRACT CONDITIONS as listed in the Table of Contents, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. Furnish and install:
 - 1. Field finished hardwood strip flooring to match existing.
- B. Perform complete sanding and finishing operations for exposed to view surfaces of all wood strip flooring and other wood items to be furnished hereunder.

1.3 RELATED REQUIREMENTS

- A. Section 02 41 19 - SELECTIVE DEMOLITION: Removal of existing finishes.
- B. Section 03 30 00 - CAST-IN-PLACE CONCRETE: Concrete substrate for resilient flooring.
- C. Section 06 10 00 – ROUGH CARPENTRY: Wood substrate.
- D. Section 09 05 60 - COMMON WORK RESULTS FOR FLOORING: General requirements for flooring preparation, substrate testing requirements, installation and temporary protection, for the work of this Section 09 65 29.
- E. Section 09 68 00 - CARPETING: Carpet and transition strips.

1.4 REFERENCES

- A. Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
 - 1. ASTM E 84 - Surface Burning Characteristics of Building Materials.
 - 2. NOFMA - Grading Rules and Installation Specifications.
 - 3. WSFI - Recommendations for the Correct Preparation, Finishing, and Testing of Concrete Subfloor Surfaces to Receive Wood Flooring.
 - 4. All applicable federal, state and municipal codes, laws and regulations regarding flammability and smoke generation of interior finishes.

July 11, 2018

1.5 ADMINISTRATIVE REQUIREMENTS

- A. Pre-installation Meetings: Installer of the Work of this Section is required to attend pre-installation conference specified under Section 09 05 06 – COMMON WORK RESULTS FOR FLOORING.

1.6 SUBMITTALS

- A. Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
1. Literature: Manufacturer's product data sheets, specifications, performance data for each type of wood flooring [and finish system] materials, with manufacturer's installation instructions and recommended maintenance procedures.
 2. Installation instructions: Submit manufacturer's NOFMA instructions, indicating special procedures, and perimeter conditions requiring special attention.
 3. Manufacturer's warranties: Wood flooring and finish system manufacturers' standard written guarantees covering defects in materials and workmanship, clearly defining the terms included in the coverage.
 4. Shop drawings: Indicate direction of flooring for each space, joint pattern (as applicable), and termination details.
 5. Verification samples:
 - a. Strip flooring: At least six (6) 12-inch long pieces of specified specie, grade, and size of flooring, indicating complete range of color variation which may be expected for the project.
- B. Submit the following under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS:
1. Maintenance data: Include maintenance procedures, recommended maintenance materials, a suggested schedule for cleaning, stripping, and re-finishing, stain removal methods, and polishes and waxes.

1.7 QUALITY ASSURANCE

- A. Manufacturer: Companies specializing in manufacturing the products specified in this Section, each with minimum 5 years documented experience.
- B. Installer specializing in applying the work of this Section with a minimum of 5 years documented experience of the type of flooring system specified.
- C. Each board of flooring shall bear grade stamp on underside identifying Grading authority, manufacturer's identification, wood species and grade.
- D. Perform work in accordance with NOFMA.

1.8 REGULATORY REQUIREMENTS

- A. Conform to applicable codes for Class 1 flame spread rating of finished floor surface when tested in accordance with ASTM E 84. Provide certificate of compliance from authority having jurisdiction.

July 11, 2018

1.9 DELIVERY, STORAGE AND HANDLING

- A. Deliver wood flooring a minimum of 7 days prior to installation to allow materials moisture content to stabilize to ambient conditions. Do not deliver wood until all concrete, masonry, plaster and other wet work is complete and dry, and ambient air at installation space has moisture content stabilized.
- B. Protect wood flooring from excessive moisture in shipment and handling; store all materials in an elevated, protected, and dry location.

1.10 PROJECT CONDITIONS

- A. Maintain ambient temperature between 55 and 80 degrees Fahrenheit, with a relative humidity of between 35 and 50 percent for 48 hours prior to delivery and storage of the flooring materials at the area; maintain such conditions throughout the installation and finishing period, and thereafter until Owner's Final Acceptance or Owner's occupancy.

1.11 SEQUENCING AND SCHEDULING

- A. Sequence work to ensure wood flooring is not delivered until building is enclosed, sufficient heat is provided, and proper humidity conditions can be maintained.
- B. Install wood flooring after interior wet work is complete and fully cured, and ambient air at installation space has a moisture content stabilized.

1.12 WARRANTY

- A. Provide 5 year warranty under provisions of the Section 01 78 00 - CLOSEOUT SUBMITTALS. Warranty shall include coverage for all costs to repair or replace flooring, which shrinks, warps, cracks, or otherwise deteriorates excessively, or which breaks its anchorage, or bond with substrate, or otherwise fails. Warranty shall cover failures due to materials or workmanship. The Installer is not responsible for failure due to excessive moisture penetration through concrete substrate or other similar causes for failure which are beyond the Work of this Section, except verification of acceptable substrates, specified herein.

PART 2 - PRODUCTS

2.1 FLOORING MATERIALS

- A. Wood strip flooring to receive field finish:
 - 1. Oak strip flooring: Nominal 3/4 inch (25/32 inch) thick by width(es) to match existing, kiln-dried quarter sawn Red Oak (*Quercus Rubra*), NOFMA grade-marked Select and better, tongue and grooved and end-matched, and delivered to the project in bundles bearing the specified grade marking.
 - 2. Provide flooring not less than 9 inches, with not more than 15 percent 12 inches or shorter.
 - 3. Floor edgings: Quarter sawn solid Red Oak, AWI Custom Grade, of sizes and profiles indicated on the Drawings.
- B. Provide wood transitional strips and perimeter closure pieces as required matching selected floor species and finish.

2.2 FINISHING MATERIALS

- A. Sandpapers: Number 1-1/2 graduating to 1/2; followed by Numbers 0 and 00 for final sanding, except as otherwise recommended by the flooring manufacturer.
- B. Filler: Paste wood filler, in tone as selected by the Architect.
- C. Field applied, floor finish:
 - 1. Stain: To match Architect's control sample and compatible with floor finish system. (Match finish of existing flooring)
 - 2. Sealer: Basic Coatings, Des Moines IA., product "Hydroline sealer".
 - 3. Water base catalyzed urethane coating system: Basic Coatings, Des Moines IA., product "Street ShoeXL Commercial Wood Floor Finish".
 - a. VOC: Catalyzed, not exceed 350 grams per liter.
 - b. Solids content: 31 percent.
 - c. Luster Satin finish, 30 units at 60 degrees on wood.

2.3 ACCESSORIES

- A. Filler for patching, smoothing and leveling flooring substrate: Refer to Section 09 05 60 – COMMON WORK RESULTS FOR FLOORING.
- B. General Requirements for flooring Adhesives: Refer to Section 09 05 60 – COMMON WORK RESULTS FOR FLOORING.
- C. Protection paper: Waxed kraft paper. or red rosin paper.
- D. Fasteners:
 - 1. Fasteners for flooring: 7d or 8d cut nails or screw-type nails, or other fasteners as recommended by the flooring manufacturer, for blind-method installation over plywood underlayment.
- E. Filler for patching, smoothing and leveling subfloors and underlayment: Portland cement-based latex underlayment acceptable to flooring manufacturer, equal to the following:
 - 1. Ardex, Inc., products "Feather Flash" and "Ardex SD-P".
 - 2. Quikrete Companies, product "Fast-Set Underlayment 1248".
 - 3. Silpro Masonry Systems Inc., product "Masco Latex Cement"

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verification of Conditions: Inspect all surfaces and verify that they are in proper condition to receive the work of this Section.
 - 1. Verify that permanent heat, light, and ventilation is complete and operational prior to installation.
 - 2. Inspect all substrate surfaces and verify that they are in proper condition to receive the work of this Section.

- a. Verify that wood subfloor is properly secured, is smooth and flat to plus or minus 1/8 inch in 10 feet, free of foreign substances.
 3. Verify that required flooring mounted utilities are in proper location.
 4. Beginning of installation means acceptance of existing substrate and project conditions.
- B. Preinstallation Testing, Evaluation and Assessment: Moisture testing of concrete substrate, refer to Specification Section 09 05 60 – COMMON WORK RESULTS FOR FLOORING.
1. Beginning of installation means acceptance of existing substrate and site conditions.
- 3.2 PREPARATION
- A. Comply with flooring manufacturer's requirements for preparation of substrate to receive wood flooring.
 - B. Remove sub-floor ridges and bumps. Fill minor or local low spots, cracks, joints, holes, and other defects with subfloor filler to achieve smooth, flat, hard surface. Prohibit traffic until filler is cured.
 - C. Thoroughly vacuum clean all receiving surfaces before commencing installation work.
 - D. Open bundles of flooring, and permit the pieces to properly acclimatize prior to installing same.
- 3.3 INSTALLATION - GENERAL
- A. Install in accordance with manufacturer's instructions and the WSFI recommendations for subfloor preparation.
 - B. Lay flooring parallel to direction indicated on approved shop drawings. Verify alignment as work progresses. Arrange strips with staggered end joints and end grain, matched, set joints flush and tight.
 - C. Terminate flooring at centerline of door openings where adjacent floor finish is dissimilar. Provide divider strips.
 - D. Expansion Space: Provide adequate expansion space at walls, columns or other projections into the floor surface. Provide expansion space per the following:
 1. In wood floor areas of less than 1,000 square feet, allow an expansion space equal to 1/16 inch per foot of width of installation.
 2. In wood floor areas of greater than 1,000 square feet, allow an expansion space of 1-3/4 inch at walls and 1 inch at columns and other projections.
 - E. Install edge strips at unprotected or exposed edges, and where flooring terminates. Secure metal strips before installation of flooring with stainless steel screws.
 - F. Install flooring tight to floor access covers.

3.4 INSTALLATION - NAILED

- A. Perform the installation in strict accordance with the referenced installation standards and specifications, and with additional requirements as specified herein.
- B. Blind-nail flooring in place through the tongue edges with specified fasteners spaced 10 to 12 inches apart, driving the fasteners at an approximate 45-degree angle.
- C. Install wood treads, risers, facings, and edgings, in accordance with the details on the Drawings, blind-nailing throughout.

3.5 CLEANING

- A. Daily clean work areas by sweeping and disposing of debris, scraps, and sawdust.
- B. Upon completion of the work of this Section in any given area, remove tools, equipment and all rubbish and debris from the work area; leave area in broom-clean condition.
- C. General: Comply with requirements of Section 01 73 00 – EXECUTION for periodic and final cleaning, and as additionally specified herein.
 - 1. Control accumulation of waste materials and trash. Daily clean work areas by sweeping and disposing of debris, and scraps.
 - 2. As work progresses, remove excess adhesive from floor, base and wall surfaces without damage.
 - 3. Upon completion of the work of this Section in any given area, remove tools, equipment and all rubbish and debris from the work area; leave area in broom-clean condition.
 - 4. Clean and polish floor surfaces in accordance with manufacturer's instructions.

3.6 PROTECTION

- A. General: Protect finished work under provisions Section 09 05 60 – COMMON WORK RESULTS FOR FLOORING.

End of Section

Section 09 65 20
RESILIENT PLANK FLOORING

PART 1 – GENERAL

1.1 GENERAL PROVISIONS

- A. The BIDDING REQUIREMENTS, CONTRACT FORMS, and CONTRACT CONDITIONS as listed in the Table of Contents, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. General: The work of this Section consists of resilient tile flooring where shown on the Drawings, as specified herein, and as required for a complete and proper installation. Work includes, substrate testing and preparation, furnishing and installation of flooring, and temporary protection until Owner's acceptance.
- B. Furnish and install the following:
 - 1. Luxury vinyl plank simulated wood grain flooring.
 - 2. Vinyl transition strips wherever edges of resilient tile flooring materials abut dissimilar flooring, where no thresholds occur.

1.3 RELATED REQUIREMENTS

- A. Section 02 41 19 - SELECTIVE DEMOLITION: Removal of existing finishes.
- B. Section 03 30 00 - CAST-IN-PLACE CONCRETE: Concrete substrate for resilient flooring.
- C. Section 06 10 00 - ROUGH CARPENTRY: Plywood underlayment.
- D. Section 09 05 60 - COMMON WORK RESULTS FOR FLOORING: General requirements for flooring preparation, substrate testing requirements, installation and temporary protection, for the work of this Section 09 65 20.
- E. Section 09 68 00 - CARPETING: Carpet and transition strips.

1.4 REFERENCES

- A. Referenced Standards: Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. The standards referenced herein are included to establish recognized minimum quality only. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern. Equivalent quality and testing standards will be acceptable, subject to their timely submission, review and acceptance by the Architect.
 - 1. ASTM E 84 - Surface Burning Characteristics of Building Materials.

2. ASTM F-710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.
3. ASTM F 970 – Standard Test Method for Static Load Limit.
4. ASTM F-1066 – Vinyl Composition Floor Tile.
5. ASTM F-1482 – Standard Practice for Installation and Preparation of Panel Type Underlayments to Receive Resilient Flooring.
6. FS SS-T-312 - Tile, Floor: Asphalt, Rubber, Vinyl, Vinyl Composition.
7. NFPA 99 – Standard for Health Care Facilities
8. NFPA 253 - Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source.
9. All applicable federal, state and municipal codes, laws and regulations regarding flammability and smoke generation of interior finishes.

1.5 ADMINISTRATIVE REQUIREMENTS

- A. Pre-installation Meetings: Installer of the Work of this Section is required to attend pre-installation conference specified under Section 09 05 06 – COMMON WORK RESULTS FOR FLOORING.
- B. Sequencing:
 1. Ensure that installation of flooring and accessories occurs after other finishing operations, including painting.

1.6 SUBMITTALS

- A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
 1. Product Data: Manufacturer's product data sheets, specifications, performance data, physical properties and installation instructions for each item furnished hereunder.
 - a. Furnish manufacturer's product literature on flooring adhesive, highlight adhesive properties, including VOC's and maximum moisture pressure limits for substrates.
 2. Shop drawings: 1/4 inch scale plans of each flooring area scheduled for Work of this Section. Drawings shall bear dimensions of actual measurements taken at the project.
 - a. Identify each flooring type, colors and patterns, indicate layout of tile units and direction of tile patterns.
 - b. Where more than one adhesive type is specified or otherwise required by flooring manufacturer, identify on shop drawings areas for each adhesive type.
 3. Selection samples: Manufacturers' sample chain of colors and patterns available for selection by Architect.
 4. Verification samples:
 - a. Full sized flooring tile, illustrating color, and pattern for each color and type of tile selected.
 - b. Edging: 12 inches long demonstrating profile, thickness, size and color.

5. Certificates:
 - a. Submit the manufacturer's certification that the resilient flooring has been tested by an independent laboratory and complies with the required fire tests.
 - B. Closeout Submittals: Submit the following under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS.
 1. Operation and Maintenance Data: Furnish cleaning and maintenance data.
 2. Bonds and Warranty Documentation:
 - a. Manufacturer's Warranties and Guarantees as specified elsewhere herein this Section.
 - C. Maintenance Material Submittals: Submit the following under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS. Clearly label and package extra materials securely to prevent damage.
 1. Extra Stock Materials: Upon completion of the Work of this Section, deliver to the Owner extra flooring materials for future repairs and maintenance, from the same manufacturing runs as those installed, in the following amounts.
 - a. Vinyl composition tile: 3 percent of each material in each color, and pattern installed.
 - b. Furnish a quantity of adhesive of each type used in sealed cans or containers sufficient to apply the above materials.
- 1.7 QUALITY ASSURANCE
- A. General: Notify the Architect where conflicts apply between referenced standards and existing materials, and existing methods of construction.
 1. Provide types of resilient tile and accessories supplied by one manufacturer, including leveling and patching compounds, and adhesives.
 2. Avoid color and pattern differential; provide flooring from one production run in any single room or contiguous areas.
- 1.8 DELIVERY, STORAGE AND HANDLING
- A. Delivery and Acceptance Requirements:
 1. Do not deliver items to the site, until all specified submittals have been submitted to, and approved by, the Architect.
 2. Do not deliver flooring materials to the project until all concrete, masonry, plaster and other wet work has been completed and dry.
 3. Deliver resilient flooring materials in original, unopened packages and store protected for three days prior to installation in area of installation to achieve temperature stability.
 - B. Storage and Handling Requirements:
 1. Store and handle materials following manufacturer's recommended procedures, and in accordance with material safety data sheets. Store materials in a clean dry, enclosed space off the ground and protected from the weather

2. Protect materials from damage due to moisture, direct sunlight, excessive temperatures, surface contamination, corrosion and damage from construction operations and other causes.
3. Protect adhesives from freezing.

1.9 SITE CONDITIONS

- A. Temperature and Humidity: Maintain uniform temperature of minimum of 65 degrees Fahrenheit and humidity of 20 to 40 percent 48 hours prior to, during, and 48 hours after installation. Store resilient flooring materials and accessories in the spaces where they will be installed for at least 48 hours before beginning installation. Thereafter, maintain a minimum temperature of 55 degrees Fahrenheit in the areas where the work is completed.

1.10 WARRANTY

- A. General: Submit warranties under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS.
 1. Manufacturer Warranty: provide manufacturer's standard wear warranties for all flooring materials installed under this Section.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design: To establish a standard of quality, design and function desired, Drawings and specifications have been based on Gerflex USA, Chicago, IL., Product: "Gerflor Creation Clic 6mm 20 mil wearlayer- loose lay, clic system."
- B. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
 1. Gerflex USA, Chicago, IL. (Basis of Design).
 2. Mohawk Industries, Calhoun GA.
 3. Shaw Contract Group, Dalton, GA.

2.2 DESCRIPTION

- A. Regulatory Requirements:
 1. Provide materials and assemblies conforming to applicable building codes and regulatory agencies for flame/fuel/smoke rating requirements of flooring in accordance with ASTM E 84.
 2. Provide flooring material to meet the following fire test performance criteria as tested by a recognized independent testing laboratory:
 - a. ASTM E 648 (Critical Radiant Flux) of 0.45 watts per sq. cm. or greater, Class 1.
 - b. ASTM E 662 (Smoke Generation) Maximum Specified Optical Density of 450 or less.

July 11, 2018

2.3 VINYL PLANK FLOORING

A. General:

1. Luxury vinyl plank floor, loose lay "clic" system.
2. Planks shall be a minimum 5.0 mm thick heterogeneous, straight edge, vinyl flooring composed of a solid polyvinyl chloride backing layer with a wear layer having manufacturers standard coating, complying with the requirements of ASTM F 1700, Class III, Type B.
 - a. Color/pattern shall be as selected by the Architect from manufacturer's full available range.

B. Acceptable products include the following:

1. Gerflex USA, Chicago, IL. (Basis of Design); product: "Creation Clic."
 - a. Plank Size: 6.9 inches width by 39.4 inches length
 - b. Total Thickness (ASTM F386): 1/4 inch [6mm].
 - c. Wear layer thickness (ASTM F410): 28 mil [0.7mm].
2. Mohawk Industries, Calhoun GA; product: "Living Local."
 - a. Plank Size: 5.84 inches by 47.8 inches.
 - b. Total Thickness (ASTM F386): 4.5 mm.
 - c. Wear layer thickness (ASTM F410): 20 mil [0.5mm].
3. Shaw Contract Group, Dalton, GA; product: "Quiet Cover", with "in step locking system."
 - a. Plank Size: 7.28 inches width by 47.72 inches length
 - b. Total Thickness (ASTM F386): 5mm.
 - c. Wear layer thickness (ASTM F410): 20 mil [0.5mm].

2.4 ACCESSORIES

- A. Filler for patching, smoothing and leveling flooring substrate: Refer to Section 09 05 60 – COMMON WORK RESULTS FOR FLOORING.
- B. General Requirements for flooring Adhesives: Refer to Section 09 05 60 – COMMON WORK RESULTS FOR FLOORING.
- C. Transition and edge strips:
 1. General: Homogeneous vinyl, of profiles required for thickness of abutting materials.
 2. Edge strips: Tapered or bull nose edge.
 3. Colors: Match or contrast with the flooring, as selected by the Architect from standard colors available, of width shown on the drawings.
- D. Cleaning material: Domestic neutral floor detergent having a pH 7 or pH 8, as recommended by the flooring manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verification of Conditions: Inspect all surfaces and verify that they are in proper condition to receive the work of this Section.
- B. Preinstallation Testing, Evaluation and Assessment: Moisture testing of concrete substrate, refer to Specification Section 09 05 60 – COMMON WORK RESULTS FOR FLOORING.
 - 1. Beginning of installation means acceptance of existing substrate and site conditions.

3.2 PREPARATION

- A. General: Comply with requirements specified under Section 09 05 60 – COMMON WORK RESULTS FOR FLOORING, the flooring manufacturer's requirements for preparation of substrate to receive resilient flooring, and as additionally specified herein.

3.3 INSTALLATION

- A. Install all products in strict accordance with each manufacturer's written installation procedures and other provisions specified herein.
 - 1. Apply primers as recommended by adhesive manufacturer's written instructions.
- B. Spread only enough adhesive to permit installation of materials before initial set.
- C. Mix tile to ensure that concentration of surface patterns is uniform throughout. Use tile from cartons in same sequence as manufactured and packaged, if so numbered.
- D. Maintain reference markers, holes and openings that are in place or have been marked for future cutting; repeat markers on flooring as marked on substrate. Use non-permanent marking devices which may be cleanly washed off when no longer required.
- E. Lay flooring in a square grid pattern, with joints and seams parallel to building lines. Lay tile flooring with pattern-grain running in singular direction approved by Architect. Lay plank with joints straight and continuous in both directions and with border planks not less than 1/2 the width of the tile.
- F. Neatly fit resilient materials to all intersecting surfaces, and make joints as inconspicuous as possible.
- G. Terminate flooring at centerline of door in closed position where adjacent floor finish is of different material or color.
- H. Apply resilient materials to have uniform contact with receiving surfaces throughout, with tight joints, and with all finish surfaces smooth, in true plane, free from buckles, waves, and other imperfections.

July 11, 2018

- I. Extend resilient flooring to wall lines beneath all movable equipment and movable casework. Fit resilient flooring onto breaks and recesses, against non-resilient bases, around pipes and other protrusions, under saddles, and to and around other fixed surfaces, making neat cuts in the flooring and minimizing joints.

3.4 INSTALLATION OF ACCESSORIES

- A. Resilient edge and transition strips:
 1. Install edge strips at all edges of flooring which would otherwise be exposed.
 2. Place resilient edge strips tightly butted to flooring and secure with adhesive recommended by the edge strip manufacturer.

3.5 CLEANING

- A. General: Comply with requirements of Section 01 73 00 – EXECUTION for periodic and final cleaning, and as additionally specified herein.
 1. Control accumulation of waste materials and trash. Daily clean work areas by sweeping and disposing of debris, and scraps.
- B. Post-installation Cleaning:
 1. As installation progresses, continually remove excess adhesive from floor, and wall surfaces without damage.
 - a. Protect installed flooring as recommended by the flooring manufacturer against damage from rolling loads, other trades, or the placement of fixtures and furnishings.
 2. Sweep floors to remove all loose dirt and debris.
 3. After flooring manufacturer's recommended waiting period, clean all materials installed hereunder with a non-abrasive commercial detergent approved by the material manufacturers, and thoroughly rinse with clear water.
 - a. Vinyl composition tile floors: Wait at least 5 full days following completion of tile installation before commencing with cleaning.
- C. Final Cleaning:
 1. General: Perform final cleaning not before 4 days prior to Owner's intended occupancy date.
 - a. Wash floors with non-abrasive commercial detergent with floor machine equipped with green or blue pad. Apply manufacturer's recommended stripping solution when floors are badly soiled.
 - b. Apply a minimum of two coats of acrylic floor polish to protect flooring until regular maintenance procedures can be started.
 - c. After application and curing of floor polish, ensure that polished floors are protected with heavy kraft paper.

3.6 PROTECTION

- A. General: Protect finished work under provisions of Section 09 05 60 – COMMON WORK RESULTS FOR FLOORING.
 1. Prohibit traffic on finished floor areas until flooring adhesive has fully set.

July 11, 2018

POPE'S TAVERN
ADDITION/RENOVATION
Halifax, Massachusetts

2. Prohibit washing, scrubbing or other similar 'wet' operations to occur on finished floor areas for a minimum period of 5 calendar days after installation.

End of Section

Section 09 65 23
RUBBER FLOORING

PART 1 - GENERAL

- 1.1 GENERAL PROVISIONS
- A. The BIDDING REQUIREMENTS, CONTRACT FORMS, and CONTRACT CONDITIONS as listed in the Table of Contents, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
 - B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.
- 1.2 SUMMARY
- A. Furnish and install the following:
 - 1. Raised-stud rubber treads/risers.
 - 2. Raised-stud rubber flooring tile at stair landings.
 - 3. Rubber base and trim related to rubber flooring provided by this Section.
 - 4. Transition strips wherever edges of resilient rubber flooring materials abut dissimilar flooring, where no thresholds occur.
- 1.3 RELATED REQUIREMENTS
- A. Section 03 30 00 - CAST-IN-PLACE CONCRETE: Concrete substrate for rubber flooring.
 - B. Section 06 10 00 - ROUGH CARPENTRY: Plywood underlayment, wood blocking and nailers.
 - C. Section 09 05 60 - COMMON WORK RESULTS FOR FLOORING: General requirements for flooring preparation, substrate testing requirements, installation and temporary protection, , for the work of this Section 09 65 23.
 - D. Section 09 65 20 - RESILIENT PLANK FLOORING: Resilient plank flooring.
- 1.4 REFERENCES
- A. Referenced Standards: Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
 - 1. ASTM E 84 - Surface Burning Characteristics of Building Materials.
 - 2. ASTM F-710 - Preparing Concrete Floors to Receive Resilient Flooring.
 - 3. ASTM F-1344 - Specification for Rubber Floor Tile.
 - 4. All applicable federal, state and municipal codes, laws and regulations regarding flammability and smoke generation of interior finishes.

July 11, 2018

1.5 ADMINISTRATIVE REQUIREMENTS

- A. Pre-installation Meetings: Installer of the Work of this Section is required to attend pre-installation conference specified under Section 09 05 06 – COMMON WORK RESULTS FOR FLOORING.

1.6 SUBMITTALS

- A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
1. Product Data: Manufacturer's product data sheets, specifications, performance data, physical properties and installation instructions for each item furnished hereunder.
 - a. Furnish manufacturer's product literature on flooring adhesive, highlight adhesive properties, including VOC's and maximum moisture pressure limits for substrates.
 2. Shop Drawings: 1/4 inch scale plans of each flooring area scheduled for Work of this Section. Drawings shall bear dimensions of actual measurements taken at the project.
 - a. Identify each flooring type, colors and patterns, indicate layout of tile units and direction of tile patterns.
 - b. Show location of welded seams and joints with abutting materials.
 - c. Where more than one adhesive type is specified or otherwise required by flooring manufacturer, identify on shop drawings areas for each adhesive type.
 3. Selection Samples: Manufacturers' sample chain of colors and patterns available for selection by Architect.
 4. Verification Samples:
 - a. Full sized flooring tile, illustrating color, and pattern for each color and type of tile selected.
 - b. Stair treads: 12 inch lengths of stair treads, illustrating color.
 - c. Edging: 12 inches long demonstrating profile, thickness, size and color.
 5. Certificates: Submit the manufacturer's certification that the resilient flooring has been tested by an independent laboratory and complies with the required fire tests.
- B. Closeout Submittals: Submit the following under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS.
1. Operation and Maintenance Data: Furnish cleaning and maintenance data. Include maintenance procedures, recommended maintenance materials, a suggested schedule for cleaning, stain removal methods, and polishing.
 2. Bonds and Warranty Documentation: Manufacturer's Warranties and Guarantees as specified elsewhere herein this Section.
- C. Maintenance Material Submittals: Submit the following under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS. Clearly label and package extra materials securely to prevent damage.

July 11, 2018

1. Extra Stock Materials: Upon completion of the Work of this Section, deliver to the Owner extra flooring materials for future repairs and maintenance, from the same manufacturing runs as those installed, in the following amounts.
 - a. Rubber Flooring Tile: 3 percent of each material in each color, and pattern installed.
 - b. Sheet Rubber Flooring: 3 percent of each material in each color, and pattern installed.
 - c. Furnish a quantity of adhesive of each type used in sealed cans or containers sufficient to apply the above materials.

1.7 QUALITY ASSURANCE

- A. General: Notify the Architect where conflicts apply between referenced standards and existing materials, and existing methods of construction.
- B. Sole Source Materials: For each type of flooring required for the work of this Section, provide primary materials which are the products of one manufacturer. Provide secondary materials which are acceptable to the manufacturer of the primary materials. Comply with applicable regulations regarding VOC (volatile organic compound) content of adhesives.
- C. Color Matching: Provide resilient flooring products, including accessories, from one manufacturer to ensure color matching.
 1. Avoid color and pattern differential; provide flooring from one production run in any single room or contiguous areas.
- D. Qualifications:
 1. Manufacturers: Provide flooring manufactured by a firm with a minimum of 10 years experience in the fabrication of resilient flooring of types equivalent to those specified.
 - a. Manufacturer capable of providing field service representation.
 2. Installer/Applicator: Installer experienced (minimum of 3 years) to perform work of this section who has specialized in the installation of work similar to that required for this project and who is acceptable to the product manufacturer.
- E. Preconstruction Testing: Perform testing for relative humidity, moisture vapor emission, and pH tests on in situ concrete slabs as specified under Section 09 05 06 – COMMON WORK RESULTS FOR FLOORING.

1.8 DELIVERY, STORAGE AND HANDLING

- A. Delivery and Acceptance Requirements:
 1. Do not deliver items to the site, until all specified submittals have been submitted to, and approved by, the Architect.
 2. Do not deliver flooring materials to the project until all concrete, masonry, plaster and other wet work has been completed and dry.
 3. Deliver flooring and setting materials in original unopened packages, containers or bundles bearing brand name, and identification of manufacturer, production run information with labels and package seals intact and legible.

July 11, 2018

- B. Storage and Handling Requirements:
 - 1. Store and handle materials following manufacturer's recommended procedures, and in accordance with material safety data sheets.
 - 2. Protect materials from damage due to moisture, direct sunlight, excessive temperatures, surface contamination, corrosion and damage from construction operations and other causes.
 - 3. Store materials in a clean dry, enclosed space off the ground and protected from the weather. Protect adhesives from freezing.
 - 4. Store protected for three days prior to installation in area of installation to achieve temperature stability.
- C. Damaged material: Remove any damaged or contaminated materials from job site immediately, including materials in broken packages, packages containing water marks, or show other evidence of damage, unless Architect specifically authorizes correction thereof and usage on project.

1.9 SITE CONDITIONS

- A. Temperature and Humidity: Maintain uniform temperature of minimum of 65 degrees Fahrenheit and humidity of 20 to 50 percent 48 hours prior to, during, and 48 hours after installation. Store resilient flooring materials and accessories in the spaces where they will be installed for at least 48 hours before beginning installation. Thereafter, maintain a minimum temperature of 55 degrees Fahrenheit in the areas where the work is completed.

1.10 WARRANTY

- A. Under the provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS, provide manufacturer's standard wear warranties for all flooring and stair tread materials installed under this Section.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Specified Manufacturer (Basis of Design): To establish a standard of quality, design and function desired, Drawings and specifications have been based on Nora Flooring Systems., Salem NH.
- B. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
 - 1. Nora Flooring Systems, Salem NH.
 - 2. Johnsonite Inc., Chagrin Falls OH.
 - 3. Armstrong World Industries, Inc., Flooring Division, Lancaster PA

2.2 RUBBER STAIR TREADS/RISERS AND LANDINGS

- A. Floor and stair treads: Two piece nosing-tread-riser combination, Nora Flooring Systems, product "Norament 465", round surface tread design, 4.5 mm (0.18 inches) overall thickness.

1. Material: Synthetic rubber free from reground rubber, natural rubber or coarse fillers.
 2. Back of Tile: Smooth, double-sanded back.
 3. Wear Warranty: 5 years.
 4. Color: As selected.
- B. Rubber flooring tile, round surface tread design, 3.2 mm (0.13 inches) overall thickness.
1. Basis of Design: Nora Flooring System; product Norament 1902. Tile size: nominal 19-5/8 by 19-5/8 inches square (actual 501 mm by 501 mm).
 2. Material: Synthetic rubber free from reground rubber, natural rubber or coarse fillers.
 3. Back of Tile: Smooth, double-sanded back.
 4. Wear Warranty: 10 years.
 5. Slip Resistance: Static coefficient of friction (James Test), ASTM D 2047, equal to or greater than 0.6, ADA guidelines compliance.
 6. Color: Solid color selected by Architect from manufacturer's full range of colors.

2.3 ACCESSORIES

- A. Filler for patching, smoothing and leveling flooring substrate: Refer to Section 09 05 60 – COMMON WORK RESULTS FOR FLOORING.
- B. General Requirements for flooring Adhesives: Refer to Section 09 05 60 – COMMON WORK RESULTS FOR FLOORING.
- C. Transition/reducing strips: Provide tapered profiles required for transition to abutting materials, in colors and material as selected by the Architect.
1. Provide resilient edge strips of width shown on the drawings, of equal gage to flooring having tapered or bull nose edge, with color(s) to match (or contrast) flooring as selected by the Architect from full range of manufacturer's available colors.
- D. Cleaning material: Domestic floor detergent, as recommended by the flooring manufacturer.
- E. For sealing joints between the top of wall base and irregular wall surfaces such as masonry, provide plastic filler applied according to the manufacturer's recommendations.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verification of Conditions: Inspect all surfaces and verify that they are in proper condition to receive the work of this Section.
- B. Preinstallation Testing, Evaluation and Assessment: Moisture testing of concrete substrate, refer to Specification Section 09 05 60 – COMMON WORK RESULTS FOR FLOORING.

1. Beginning of installation means acceptance of existing substrate and site conditions.

3.2 PREPARATION

- A. General: Comply with requirements specified under Section 09 05 60 – COMMON WORK RESULTS FOR FLOORING, the flooring manufacturer's requirements for preparation of substrate to receive resilient flooring, and as additionally specified herein.
- B. Protection of In-situ Conditions: During the operation of work of this Section, protect surrounding materials and finishes against undue soilage and damage by the exercise of reasonable care and precautions. Clean, or repair all existing surfaces which are soiled or otherwise damaged by Work of this Section.

3.3 INSTALLATION - GENERAL

- A. General: Install all products in strict accordance with each manufacturer's written installation procedures and other provisions specified herein.
 1. Flooring Manufacturer's Specifications: The floor system manufacturer's Technical Specifications shall be considered a part of this specification and should be used as a reference for specific application procedures and recommendations. Where a conflict does exist between the manufacturer's written specifications and those procedures specified in this Section, the more stringent requirements meeting the Manufacturer's minimum requirements for the provided warranty shall apply.
- B. Install flooring and accessories after the other finishing operations, including painting, have been completed. Close spaces to traffic during the installation of the flooring.
- C. Do not install flooring over concrete slabs until they have been cured and are sufficiently dry to achieve a bond with the adhesive, in accordance with specified and manufacturer's recommended bond and moisture testing.
- D. Spread only enough adhesive to permit installation of materials before initial set.

3.4 INSTALLATION OF TREADS AND RISERS

- A. Begin installation at bottom step and continue upwards towards each landing. Cut riser part of the steptread to fit to the riser of the step below. Trim even with the edge of the riser.
- B. Cut and dry fit treads and risers before installation.
- C. Apply contact adhesive to the substrate and back of the step-tread. Permit contact adhesive to dry to touch.
 1. Apply adhesives to steps and risers.
- D. Install tread-riser combination units as recommended by manufacturer using manufacturers removable slip sheet or wax paper to locate step tread before adhering in place.
 1. Fit nosing material tight to the nosing of the stair.

July 11, 2018

- E. Use roller or stair tool to press stair materials into place. Remove excess adhesive.
- F. After installation check adhesive bond to treads and risers.

3.5 INSTALLATION - FLOOR TILE

- A. Lay flooring in a square grid pattern, with joints and seams parallel to building lines. Lay tile with joints straight and continuous in both directions and with border tile not less than 1/2 the width of the tile.
- B. Lay resilient flooring with arrows in the same direction.
- C. Neatly fit resilient materials to all intersecting surfaces, and make joints as inconspicuous as possible.
- D. Terminate flooring at centerline of door in closed position where adjacent floor finish is of different material or color.
- E. Apply resilient materials to have uniform contact with receiving surfaces throughout, with tight joints, and with all finish surfaces smooth, in true plane, free from buckles, waves, and other imperfections.
- F. Extend resilient flooring to wall lines beneath all movable equipment and movable casework. Fit resilient flooring onto breaks and recesses, against non-resilient bases, around pipes and other protrusions, under saddles, and to and around other fixed surfaces, making neat cuts in the flooring and minimizing joints.
- G. Install reducer strips at exposed edges.

3.6 INSTALLATION OF ACCESSORIES

- A. Resilient base: Install base on solid backing, bond to vertical substrate with continuous contact at horizontal and vertical surfaces. Apply wall base to walls, columns, casework and other permanent fixtures in areas where base is required.
 - 1. Install in lengths as long as practical.
 - 2. Scribe to fit to door frames and other interruptions.
 - 3. Form all external and internal corners in accordance with manufacturer's written instructions. Cope inside corners and fit neatly.
 - 4. Fill voids with plastic filler along the top edge of the resilient wall base on masonry surfaces or other similar irregular substrates.
- B. Resilient edge and transition strips:
 - 1. Install edge strips at all edges of flooring which would otherwise be exposed.
 - 2. Place resilient edge strips tightly butted to flooring and secure with adhesive recommended by the edge strip manufacturer.

3.7 TOLERANCES

- A. Maximum variation from plumb or level: 1/8 inch.
- B. Maximum offset from true dimensional alignment: 1/8 inch.

3.8 CLEANING

- A. General: Comply with requirements of Section 01 73 00 – EXECUTION for periodic and final cleaning, and as additionally specified herein.
 - 1. Control accumulation of waste materials and trash. Daily clean work areas by sweeping and disposing of debris, and scraps.
 - 2. Control accumulation of waste materials and trash. Daily clean work areas by sweeping and disposing of debris, and scraps.
 - 3. After completion of the work of this Section, remove equipment, and clean all wall, partition, and floor areas free from deposits of flooring adhesives and other materials installed under this Section.
- B. As installation progresses, continually remove excess adhesive from floor, base and wall surfaces without damage.
 - 1. Protect installed flooring as recommended by the flooring manufacturer against damage from rolling loads, other trades, or the placement of fixtures and furnishings.
- C. Sweep floors daily to remove all loose dirt and debris.
- D. Not sooner than five days after installation, clean all materials installed hereunder with a non-abrasive commercial detergent approved by the material manufacturers, and thoroughly rinse with clear water.
- E. After cleaning and polishing, ensure that the flooring is protected with heavy kraft paper.

3.9 PROTECTION

- A. General: Protect finished work under provisions Section 09 05 60 – COMMON WORK RESULTS FOR FLOORING.

End of Section

Section 09 68 00
CARPETING

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. The BIDDING REQUIREMENTS, CONTRACT FORMS, and CONTRACT CONDITIONS as listed in the Table of Contents, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. General: The work of this Section consists of carpeting where shown on the Drawings, as specified herein, and as required for a complete and proper installation. Work includes, substrate testing and preparation, furnishing and installation of flooring, and temporary protection until Owner's acceptance.
- B. Furnish and install
 - 1. Carpeting directly adhered over floors, as indicated on Drawings, including all accessories necessary to complete the work.
- C. Furnish Owner with carpet installer's written guarantee for performance of Work.

1.3 RELATED REQUIREMENTS

- A. Section 02 41 19 - SELECTIVE DEMOLITION: Removal of existing flooring finishes.
- B. Section 03 30 00 - CAST-IN-PLACE CONCRETE: concrete substrate.
- C. Section 06 10 00 - ROUGH CARPENTRY: Wood subfloor and underlayment.
- D. Section 06 20 00 - FINISH CARPENTRY: Wood thresholds and bases, installing metal thresholds.
- E. Section 08 71 00 - DOOR HARDWARE: Furnishing metal thresholds.
- F. Section 09 05 60 - COMMON WORK RESULTS FOR FLOORING: General requirements for flooring preparation, substrate testing requirements, installation and temporary protection, for the work of this Section 09 68 00

1.4 REFERENCES

- A. Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
 - 1. ASTM D 2859 - Test Method for Flammability of Finished Textile Floor Covering Materials.

July 11, 2018

2. ASTM D 418 - Methods of Testing Pile Yarn Floor Covering Construction.
3. ASTM D5116 - Guide for Small-Scale Environmental Chamber Determinations of Organic Emissions from Indoor Materials/Products.
4. ASTM E 84 - Surface Burning Characteristics of Building Materials.
5. ASTM E 648 - Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source.
6. ASTM E 662 - Test Method for Specific Optical Density of Smoke Generated by Solid Materials.
7. CRI Indoor Air Quality Testing and Labeling Program.
8. NFPA: Publication 253 - Test for Critical Radiant Flux of Floor Covering Systems.
9. All applicable federal, state and municipal codes, laws and regulations regarding flammability and smoke generation of interior finishes.

1.5 ADMINISTRATIVE REQUIREMENTS

- A. Pre-installation Meetings: Installer of the Work of this Section is required to attend pre-installation conference specified under Section 09 05 06 – COMMON WORK RESULTS FOR FLOORING.
- B. Coordination:
 1. General: Coordinate the work of this Section with the respective trades responsible for installing interfacing and adjoining work for proper sequence of installation, and ensure that the work performed hereunder is acceptable to such trades for the installation of their work.
- C. Sequencing:
 1. Ensure that installation of flooring and accessories occurs after other finishing operations and interior wet work is complete and fully cured, including painting.

1.6 SUBMITTALS

- A. Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
 1. Literature: Manufacturer's product data sheets, specifications, performance data, physical properties, for each item furnished hereunder, including carpet, accessories, adhesives, and leveling materials.
 2. Manufacturer's installation instructions: Provide manufacturer's application methods or installation instructions for each item furnished hereunder. Indicate special procedures, and perimeter conditions requiring special attention.
 3. Manufacturer's sample warranties.
 4. Manufacturer's certificate: Provide certificate stating that the carpet, and other related materials to be supplied hereunder meet all requirements specified herein.
 - a. Submit certification from the fiber producer verifying use of the branded fiber in the submitted carpet product.

5. Indoor Air Quality Test Reports: Submit for specified products, indicating that the test results do not exceed the stated emission criteria of the CRI Indoor Air Quality Testing Program.
 6. Shop drawings: 1/8 inch scale plans of all carpeted areas indicating direction of carpet, location of seams and method of joining seams.
 - a. In general, carpet layout shall comply with the following:
 - 1) All carpet to be laid in the same direction unless specifically shown otherwise.
 - 2) No seams shall occur at doorways and entries which are perpendicular to doors or entries.
 - 3) Seams occurring at corridor change of direction shall follow wall parallel to carpet direction.
 - b. Show location of different patterns or styles of carpet.
 - c. Show locations of all threshold conditions.
 7. Selection samples:
 - a. Sample swatches containing manufacturer's full color and blend range.
 - b. Resilient edge strip sample illustrating manufacturer's full color range.
 8. Verification samples:
 - a. 12 inch long samples of edge strip.
 - b. After initial selection of carpet and color blends has been made by the Architect 18 inches by 27 inches sample of selected carpet for final approval of the Architect. Approved samples shall be used as the standard of quality and colors for materials furnished under this Contract.
- B. Submit the following under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS.
1. Maintenance Data: Prior to final acceptance of the carpet installation, carpet subcontractor shall deliver to the Architect 3 printed copies of the carpet manufacturer's detailed maintenance recommendations for the care cleaning and stain-removal, and repair of the types of carpets installed. Include product data and Material Safety Data Sheets (MSDS) for cleaning materials.
- C. Maintenance Material Submittals: Submit the following under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS. Clearly label and package extra materials securely to prevent damage.
1. Extra Materials: Upon completion of the Work of this Section, Deliver to the Owner extra materials for future repairs and maintenance. Clearly label and package securely to prevent damage.
 - a. Owner's carpet stock: An amount equal to 3 percent of each color, pattern and type of carpet installed.
 2. Deliver specified overrun and usable pieces of carpet to owner's designated storage space, properly packaged and identified. Redirect small pieces of waste carpet to be appropriately recycled.

1.7 QUALITY ASSURANCE

- A. Applicator: Company specializing in carpet installation of the type specified herein with a minimum of three years documented experience.

July 11, 2018

1.8 ENVIRONMENTAL CONDITIONS

- A. Do not install carpet until areas have been fully enclosed and environmental conditions have reached the levels indicated during occupancy.
- B. Store materials for 3 days (72 hours) prior to installation in area of installation to achieve temperature and humidity stability. Carpet and adhesive must be stored at a minimum temperature of 68 degrees F.
 - 1. Unroll carpet for a period of 72 hours prior to beginning of installation for adjustment to environmental conditions.
- C. Maintain area of installation at a temperature of at least 68 degrees Fahrenheit, with a relative humidity of between 15 and 65 percent, for a period of 72 hours before, during, and for 72 hours after installation.
 - 1. Ensure surface temperature of carpet substrate is great than 55 degrees Fahrenheit at commencement of carpet tile installation.
- D. Ventilate spaces where work of this Section occurs, during and for a period of 72 hours after completion of curing. Ventilate to dissipate humidity, and to prevent accumulation of fumes, vapors, and gases. Provide temporary fan units and ducting as required to for venting operations

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Carpet subcontractor is responsible for scheduling, receiving and placement on floors of goods from the manufacturer. Goods shall be delivered to the job site in the manufacturer's bundles and be clearly marked as to size, dye-lot and materials.
- B. Deliver carpet in sealed protective rolls and accessories in sealed containers. Bind carpet materials with secure protective wrapping. Mark each carpet roll according to style, color, pattern, dye lot, run number, and quantity.
- C. Waste Reduction: Collect polyethylene roll wrap at site and recycle into more roll wrap. Redirect small pieces of waste carpet to be appropriately recycled.
- D. Store all carpeting material under cover in dry, well-ventilated spaces as soon as delivered. Protect carpeting from damage, dirt, stain, moisture, and mildew.

1.10 WARRANTY

- A. Furnish the following warranties under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS:
 - 1. Carpet manufacturer's 10 year warranty which shall include texture retention, wear, and static protection and edge ravel resistance and run resistance strength for the life of the carpet. Commencing on the date of Project Substantial Completion.
 - 2. Carpeting installer's written guarantee covering prompt and proper replacement of any and all carpeting which indicates improper installation workmanship and/or defective material within twelve months from completion of the installation and acceptance thereof by the Architect, said corrective work being performed by the Carpeting installer at no cost to the Owner.

July 11, 2018

PART 2 - PRODUCTS

2.1 CARPET

- A. General requirements: Carpet, shall conform with or pass tests of the following Standards:
1. CRI – Green Label Plus
 2. ASTM D-2859 (Methenamine Reagent Pill Test).
 3. ASTM E-648 (Flooring Radiant Panel Test): Class I (Minimum Average CRF of 0.48).
 4. NBS Smoke Chamber Test: Maximum average of 450.
 5. AATCC-134 (Electrostatic Propensity): Maximum electrostatic generation below level of human sensitivity.
- B. Carpet Basis of Design (PROPRIETARY): To establish a standard of quality, design and function desired, Drawings and specifications have been based on Mannington Carpets Inc., Calhoun, GA. , Product: "CANOPY II – Integra HP," in style/pattern number 12287, color "Paris".
1. Regarding Awarding Authority's proprietary products: Under provisions of Massachusetts General Laws, Chapter 30, Section 39M(b) the Awarding Authority has determined that the broadloom carpet specified herein shall be proprietary for 'sound reasons in the public interest'. This determination has been made under vote of the Awarding Authority, and has been recorded in writing for public record.
 2. Substitutions: The products specified herein establish strict standards of quality, design and function desired, and have been deemed proprietary. Under provisions of Massachusetts General Laws, Chapter 149, other equal products not named herein, may be considered for acceptance as an equal by the Architect upon submission of complete product information as described in the CONDITIONS OF CONTRACT and Division 1 - GENERAL REQUIREMENTS.
 - a. Further additional information may be requested by the Architect for determination that the proposed product substitution is fully equal to the specified product(s). There is no guarantee that proposed substitutions will be approved, and the Contractor is hereby directed not to order any materials until said approval(s) are received in writing.
 - b. Requesting substitutions for the products specified herein is at the Contractor's own risk, with regard to uncompensated delays of the Project. Time is required for sufficient review and additional requests for information. Delays of work which result from substitution reviews and resubmissions are not grounds for additional time or cost change orders, and will not be considered by the Awarding Authority.
- C. Carpet criteria:
- | | |
|-------------------|---|
| Construction: | Pattern Loop |
| Pile Fiber: | Invista Anton Legacy Type 6.6 Four Hole,
Hollow Filament Nylon with permanent stain
and bleach protection |
| Stiches per Inch: | 12.33 |
| Gauge: | 5/64 |

Pile Height:	0.118 inches
Pile Weight:	25 ounces
Density:	6,711 (average)
Weight Density:	147,661
Primary Backing:	Synthetic
Secondary Backing:	Integra HP with chemically weldable seams.
Roll Width:	12'-6"
Color:	As selected by Architect.
Dye Method:	Yarn/Solution dyed
Static Control:	tested 3.5 kv. or less at 20 percent relative humidity.
Green Label Plus Identification Number:	GLP7616.

2.2 ACCESSORIES

- A. Filler for patching, smoothing and leveling flooring substrate: Refer to Section 09 05 60 – COMMON WORK RESULTS FOR FLOORING.
- B. General Requirements for flooring Adhesives: Refer to Section 09 05 60 – COMMON WORK RESULTS FOR FLOORING.
 - 1. General:
- C. Adhesives for carpeting: NFPA Class A or UBC Class 1 types, as determined by ASTM E-84 Tunnel Test, as recommended by Carpet manufacturer for application and intended use.
 - a. Provide low VOC adhesives that comply with the following limits for VOC content:
 - 1) Indoor carpet adhesive: 50 g/L.
 - 2) Carpet pad adhesive: 50 g/L.
 - b. Multi-Purpose Adhesive for carpet: Low VOC permanent carpet adhesive as recommended by carpet manufacturer for direct glue down of carpet; comply with CRI Green Label Plus Certification Program. Use slow-set permanent adhesive for patterned carpet to facilitate pattern match.
 - c. Multi-Purpose Adhesive at steps: Low VOC permanent carpet adhesive as recommended by carpet manufacturer for direct glue down of carpet on steps; comply with CRI Green Label Plus Certification Program.
- 2. Acceptable manufacturers are limited to the following listed manufacturers,
- D. Transition strips, carpet reducers, edgings and accessories: Composition nitrile rubber alloy, in colors as selected by the Architect.
 - 1. Acceptable manufacturers:
 - a. American Billtrite (Canada) Ltd., Sherbrooke, Quebec.
 - b. Burke Industries, San Jose, CA.
 - c. Roppe Corporation, Fostoria OH.
 - d. Freudenberg Building Systems Inc., Lawrence MA.

2. Profiles as indicated, submit shop drawings for all conditions not indicated and obtain Architect's approval for each transition/reducer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verification of Conditions: Inspect all surfaces and verify that they are in proper condition to receive the work of this Section.
 1. Ensure that newly placed concrete has cured for a minimum period of 30 days and that moisture content of concrete is within range specified by adhesive manufacturer.
 2. Verify that surfaces are smooth and flat with a maximum variation of 1/4 inch in 10 feet, and are ready to receive work.
 3. Request correction of defects in receiving surfaces which are not correctable by the methods specified herein. Do not commence work until such defects are entirely corrected
- B. Preinstallation Testing, Evaluation and Assessment: Moisture testing of concrete substrate, refer to Specification Section 09 05 60 – COMMON WORK RESULTS FOR FLOORING.
 1. Beginning of installation means acceptance of existing substrate and site conditions.

3.2 PREPARATION

- A. General: Comply with requirements specified under Section 09 05 60 – COMMON WORK RESULTS FOR FLOORING, the flooring manufacturer's requirements for preparation of substrate to receive resilient flooring, and as additionally specified herein.
- B. Preheat areas to receive carpet to a minimum temperature of 60 degrees F for 72 hours prior to installation, with a relative humidity between 15 and 60 percent. Maintain minimum temperature of 60 degrees F thereafter.
- C. Measure all areas to receive materials to be furnished and installed hereunder, and verify in the field their actual dimensions, including wall-to-wall dimensions, offsets, door locations, and details, fixed equipment, and all other installed items. Extra charges will not be allowed because of lack of familiarity with actual project conditions. Use largest carpet widths to produce minimum number of seams. Small pieces of carpet will not be acceptable.
- D. Unroll carpet for adjustment to environmental conditions at least 24 hours prior to installation.

3.3 INSTALLATION – CARPET

- A. Install carpet in accordance with carpet and environmentally approved carpet adhesive manufacturers' instructions. Immediately notify Architect of conflicts.
- B. Layout carpet with location of seams per approved shop drawings.

- C. Cement carpet directly to the substrate with specified installation adhesive. Trowel adhesive evenly on the substrate. Install the carpet within thirty minutes after spreading adhesive.
 - 1. Apply a 6 inch wide band of specified seaming adhesive continuously at each seam location, before bedding the carpet therein, ensuring that each carpet edge will be embedded therein at least 3 inches.
 - 2. Apply a continuous band of specified edge adhesive around entire perimeter edge of each carpeted area, and embed the carpeting therein.
- D. Roll all carpet areas with a 30 pound carpet roller to ensure proper contact of carpet with adhesive, and to remove all bubbles and buckles. Carefully roll seams and edges with the roller centered over the seam.
- E. Run all carpet in the same direction. Plan and install carpet in all areas so that single pieces per area shall be used to the fullest extent possible. No seams will be permitted in areas which are 12 feet, or less, in width.
- F. Carefully measure all cut-outs at the project.
- G. Make all seams in carpeting by back-cutting the carpet on an angle so that the face yarn of abutting pieces intermingles, and provides a practically invisible transition at each seam location.
 - 1. Center seams, occurring at door openings, parallel to, and directly under, the doors.
 - 2. Seams occurring at corridor changes in direction shall follow wall line parallel to carpet direction.
 - 3. Do not center seams in travel path to doors.
- H. Do not center seams in path, perpendicular to, in the path of, or travel to doors.
- I. Install specified edging wherever carpeting abuts a dissimilar flooring material, except where wood thresholds, or resilient floor tile trim occurs.

3.4 CLEANING

- A. General: Comply with requirements of Section 01 73 00 – EXECUTION for periodic and final cleaning, and as additionally specified herein.
 - 1. Control accumulation of waste materials and trash. Daily clean work areas by sweeping and disposing of debris, and scraps.
- B. Daily clean work areas by disposing of carpet scraps.
- C. After completion of the work of this Section:
 - 1. Remove equipment, and clean all wall, partition, and floor areas free from deposits of adhesives and other materials installed under this Section.
 - 2. Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet manufacturer.
 - 3. Remove yarns that protrude from carpet surface.
 - 4. Clean and vacuum carpet surfaces.

July 11, 2018

POPE'S TAVERN
ADDITION/RENOVATION
Halifax, Massachusetts

- D. Perform final cleaning and vacuuming carpet surfaces not less than 4 days prior to Owner's intended occupancy date.

3.5 PROTECTION

- A. General: Protect finished work under provisions of Section 09 05 60 – COMMON WORK RESULTS FOR FLOORING.
 - 1. Prohibit traffic from carpet areas for 24 hours after installation.
 - 2. Protect carpet against damage during construction. Cover with not less than 6-mil thick polyethylene covering with taped joints during construction period whenever protection is required, so that carpet will be without any indication of deterioration, wear, or damage at time of completion.
 - 3. Maintain protection of carpeting on each floor or area until work is accepted.

End of Section

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Section 09 81 00
ACOUSTICAL INSULATION

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. The BIDDING REQUIREMENTS, CONTRACT FORMS, and CONTRACT CONDITIONS as listed in the Table of Contents, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. Furnish and install:
 - 1. Acoustical insulation as scheduled and where indicated.

1.3 RELATED REQUIREMENTS

- A. Section 06 10 00 - ROUGH CARPENTRY: Wood framing, blocking, nailers.
- B. Section 07 21 00 – THERMAL INSULATION.
- C. Section 09 22 16 - NON-STRUCTURAL METAL FRAMING: ceiling framing.
- D. Section 09 29 00 - GYPSUM BOARD: Installation of wall board over acoustical insulation.
- E. Division 23 - HEATING, VENTILATING AND AIR CONDITIONING: Ductwork and piping insulation.

1.4 REFERENCES

- A. Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
 - 1. ASTM C 518 - Thermal Transmission Properties by Means of the Heat Flow Meter.
 - 2. ASTM E 84 - Surface Burning Characteristics of Building Materials.
 - 3. ASTM E 96 - Water Vapor Transmission of Materials.

1.5 SUBMITTALS

- A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
 - 1. Product Data: Manufacturer's product data sheets, specifications, performance data, physical properties for each item furnished hereunder.
 - 2. Certificates:

- a. Provide manufacturer's written certification of recycled glass content in glass fiber acoustical insulation.
- b. Provide manufacturer's written certification of recycled slag content in mineral wool insulation.
3. Sustainable Design Submittals: Indicate post-consumer and pre-consumer recycled content and provide documentation certifying products are from recycled sources.
 - a. Include statement indicating costs for each product having recycled content.

1.6 DELIVERY, STORAGE AND HANDLING

A. Delivery and Acceptance Requirements:

1. Deliver materials in original packages, containers or bundles bearing brand name and identification of manufacturer or supplier.
2. Do not deliver items to the site, until all specified submittals have been submitted to, and approved by, the Architect.

B. Storage and Handling Requirements:

1. Store materials under cover and in manner to keep them dry, protected from weather, direct sunlight and damage from construction traffic and other causes.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering similar products include the following:

1. Acoustical glass fiber insulation:
 - a. CertainTeed Corporation, Valley Forge PA.
 - b. Johns Manville Building Insulation, Denver, CO
 - c. Owens Corning Fiberglas Corp., Toledo OH.
 - d. (Goldline brand) Schuller International, Inc., Denver CO.
 - e. USG Corp./ USG Interiors Inc., Chicago IL.

2.2 MATERIALS

A. Acoustical batt insulation: Unfaced glass fiber insulation nominal 3-1/2 inches [89mm] thick conforming to ASTM C-665 Type I, of width appropriate for spacing of framing or furring members with which used.

1. Flame Spread Classification: Class A (less than 25, per testing by NFPA 255, ASTM E-84 or UL 723).
2. Recycled content of glass in glass-fiber insulation: Use maximum available percentage of recycled glass. Fiber glass insulation products incorporated into the work shall contain not less than 20 percent of recycled glass cullet.

July 11, 2018

POPE'S TAVERN
ADDITION/RENOVATION
Halifax, Massachusetts

2.3 ACCESSORIES

- A. Staples, tape, adhesives and fasteners required for the proper and complete installation for work of this Section shall be as recommended by each respective manufacturers of each insulation type.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install insulation in accordance with insulation manufacturer's instructions.
- B. Install in interior walls, and ceiling spaces where indicated. Trim insulation neatly to fit spaces. Fit insulation tight in spaces. Leave no gaps or voids.

End of Section

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Section 09 91 00
PAINTING
(FILED SUB-BID REQUIRED AS PART OF SECTION 09 00 09)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Sub-Bid Requirements: As provided under Section 09 00 09 – PAINTING FILED SUB-BID REQUIREMENTS and supplemented under the Bidding Requirements, Contract Forms, and Conditions of the Contract, and applicable parts of Division 1 - GENERAL REQUIREMENTS.
 - 1. Work of this Filed Sub-Bid includes all individual specification sections listed in Section 09 00 09.

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: This Section consists of painting work where shown on the Drawings, as specified herein, and as required for a complete and proper installation. Painting work includes, but is not limited to the surface preparation and application of coated finishes, and subsequent touch-up, of interior and exterior items and surfaces as indicated on the Contract Drawings and as scheduled herein.
 - 1. No attempt is made in this Section to list all surfaces, fixtures and equipment requiring painting on this project. It is the responsibility of the Subcontractor to determine for itself the scope and nature of the Work required for a complete installation from the information provided herein and in the Drawings.
- B. Surfaces and Materials: In general, without limiting the generality thereof, the following surfaces, fixtures and equipment require a painted finish:
 - 1. New, existing and repaired gypsum board partition and wall surfaces, ceilings and soffits, including all surfaces disrupted and repaired in the process of installing new building systems and components.
 - 2. New and existing metal doors and frames.
 - 3. Interior handrails at new stairs.
 - 4. Exterior handrails and guardrails.
 - 5. New and existing wood trim.
 - 6. Wood doors and frames.
 - 7. Exposed to view sprinkler piping.
 - 8. Exposed to view electrical conduit and raceways.
 - 9. Elevator ladder, exposed to view lintels and other miscellaneous metal items furnished under Section 05 50 00 - METAL FABRICATIONS which are not factory finished.
 - 10. Access panels and frames.
- C. DO NOT PAINT the following surfaces and materials.

July 11, 2018

1. Concealed from view surfaces, except as indicated otherwise in the Contract Documents or as specified herein.
2. Chrome or nickel plating, stainless steel, bronze, brass.
3. Aluminum other than mill finished or factory primed.
4. Factory finished mechanical and electrical equipment, pumps, machinery and similar items which occur in mechanical, storage or equipment rooms or areas.
5. Factory finished materials, specialties, and accessories unless otherwise specified.
6. Ceramic tile, resilient flooring, wood flooring, and other integrally finished floor, wall and ceiling finishes.
7. Prefinished millwork items.
8. Fire resistant testing and certification labels, code required labels, safety warning labels, performance rating plates, nomenclature plates, identification plates, and similar other labels.

1.2 RELATED REQUIREMENTS

- A. Section 02 41 19 - SELECTIVE DEMOLITION.
- B. Section 03 30 00 - CAST-IN-PLACE CONCRETE: Concrete partitions and walls.
- C. Section 04 20 00 - UNIT MASONRY: Concrete masonry partitions.
- D. Section 05 12 00 - STRUCTURAL STEEL FRAMING: Shop priming of structural steel framing.
- E. Section 05 50 00 - METAL FABRICATIONS: Shop priming of designated miscellaneous metals.
- F. Section 06 20 00 - FINISH CARPENTRY: Wood trim items, setting and filling of nails, sanding of wood trim.
- G. Section 07 92 00 - JOINT SEALANTS: Requirements for sealant and backing materials.
- H. Section 08 11 13 - HOLLOW METAL DOORS AND FRAMES: Shop priming of metal frames and steel doors.
- I. Section 08 14 33 - STILE AND RAIL WOOD DOORS: Wood doors, both prefinished and unfinished.
- J. Section 08 31 00 - ACCESS DOORS AND PANELS: Shop primed access panels, occurring in partitions and walls.
- K. Section 09 29 00 - GYPSUM BOARD: Drywall partitions, ceilings and soffits, including joint treatment and sanding.
- L. Document 09 91 13 - EXTERIOR PAINTING SCHEDULE: Painting schedule for exterior surfaces and materials:
- M. Document 09 91 23 - INTERIOR PAINTING SCHEDULE:

July 11, 2018

1. Painting schedule for interior surfaces and materials.
 2. Painting schedule for Mechanical and Electrical Equipment.
- N. Division 22 - PLUMBING: Prefinished items such as plumbing fixtures, sprinkler heads, convectors, anemostates and similar surfaces and materials.
- O. Division 26 - ELECTRICAL: Prefinished items such as light fixtures, switch gear, electrical distribution cabinets and similar surfaces and materials.
- P. Respective sections: Factory-finishing of food service, mechanical, plumbing, fire protection and electrical equipment.

1.3 REFERENCES

- A. Referenced Standards: Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. The standards referenced herein are included to establish recognized minimum quality only. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern. Equivalent quality and testing standards will be acceptable, subject to their timely submission, review and acceptance by the Architect.
1. ANSI/ASTM D 16 - Definitions of Terms Relating to Paint, Varnish, Lacquer, and Related Products.
 2. ASTM D 2016 - Test Method for Moisture Content of Wood.
 3. SSPC-Vis1 - Pictorial Surface Preparation Standards for Painting Steel Structures.
 4. SSPC-SP2 - Steel Structures Painting Manual, Volume 2, Systems and Specifications.
 5. All applicable federal, state and municipal codes, laws and regulations for flammability and smoke generation of interior finishes.
- B. Definitions:
1. "Paint" includes coating systems materials, primers, emulsions, enamels, stains, sealers and fillers, and other applied materials specified herein, whether used as prime, intermediate or finish coats.
 2. Sheen: Specular gloss readings in accordance with ASTM D52.
 - a. Flat: less than 5 (measured at 85 degrees).
 - b. Eggshell: 5 – 20 (measured at 60 degrees).
 - c. Satin: 15-35 (measured at 60 degrees).
 - d. Low Luster: 25 – 35 (measured at 60 degrees).
 - e. Semi-Gloss: 30 -65 (measured at 60 degrees).
 - f. Gloss: 65 or more (measured at 60 degrees).

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
1. General: The applicator of work specified herein is responsible to ensure that all paints, enamels, and coatings, proposed to be applied hereunder, are

compatible with coatings used for shop-primed items and items which have been prime-coated under the work of other trades.

2. Immediately notify the Architect in writing of conditions which may require a change in the specifications of this Section before proceeding with the work. Failure to do so, in a timely fashion, so as not to interfere with the schedule of work of this Contract, shall be construed as acceptance of the coatings specified. Perform all corrective measures, at no cost to the Owner, for any defects in the work, resulting from the use of such materials.
- B. Scheduling: Painting work should be scheduled so as to minimize touch-ups. Interior painting is to be without flashmarks. Should flashmarks occur due to touch-ups, the Contractor shall be required to redo the entire surrounding wall surface.
 - C. Do not order materials until all required schedules have been properly submitted, reviewed by the Contractor and Approved by Architect.

1.5 SUBMITTALS

- A. Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
 1. Literature: Manufacturer's product data sheets, specifications, performance data, physical properties, material compositions, and application instructions for all finishing products to be applied hereunder.
 - a. Include certification of data indicating Volatile Organic Compound (VOC) content of all paint materials.
 2. Samples:
 - a. Manufacturer's color selector for custom mixed colors for Architect's color scheduling.
 - b. Opaque coatings: Two 9 x 12 inch finished samples on hardboard of each color scheduled in each finish for review and approval. Identify boards with finish type, color mix number and scheduled substrate surfaces or materials.
 - c. Transparent finishes and stains: Two 9 x 12 inch finished samples on same species of solid wood and plywood to be furnished under Section 06 20 00 - FINISH CARPENTRY, of each color scheduled in each finish for review and approval. Identify boards with finish type, color mix number and scheduled substrate surfaces or materials.
- B. Submit the following under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS:
 1. Color chips: After final approval of all colors and tints by the Architect, submit to the Owner, color chips of all coatings used, with manufacturer's name and mix designation of the coating for the purpose of future re-ordering of coatings. Color chips shall be at least six (6) square inches in size, for each color and tint.

1.6 QUALITY ASSURANCE

- A. Applicator: Company specializing in commercial painting and finishing with 3 years minimum documented experience.

July 11, 2018

- B. Single source responsibility: Provide primers and other undercoat paint produced by same manufacturer as finish coats. Use only thinners approved by paint manufacturer, and use only within recommended limits.

1.7 FIELD SAMPLES

- A. Provide field samples under provisions of Section 01 45 00 - QUALITY CONTROL for purpose of verifying selected colors.
- B. Paint on-site sample areas, minimum 40 square feet, illustrating selected color, and tint.
- C. Locate samples where directed. The Contractor shall provide in the base Contract, a total amount of samples equal to one sample per room.
- D. Accepted samples may not remain as part of the work.

1.8 DELIVERY, STORAGE AND HANDLING

- A. Deliver products to site in sealed and labeled containers; container labeling shall include manufacturer's name, type of paint, color mix designation, expected coverage, surface preparation instructions, instructions for mixing and reducing, drying time, and clean-up recommendations.
- B. Store materials, conforming with applicable codes and fire regulations, in designated spaces. Keep storage area secure when direct access is not required or when not performing work under this Section. Take precautionary measures to prevent fire hazards and spontaneous combustion, maintain a dry-chemical type fire extinguisher in all areas where materials of this Section are being stored or used.
- C. Store paint materials in a well ventilated area at minimum ambient temperature of 45 degrees Fahrenheit and a maximum of 90 degrees Fahrenheit.
- D. Do not use the sanitary system for mixing or disposal of refuse material. Carry water to mixing rooms and dump waste material in a suitable refuse receptacle. Remove oily rags and waste each day.

1.9 PROJECT CONDITIONS

- A. Provide continuous ventilation and heating facilities to maintain surface and ambient temperatures above 45 degrees Fahrenheit for 24 hours before, during and 48 hours after application of finishes, unless required otherwise by manufacturer's instructions.
- B. Do not apply exterior coatings during rain or snow, or when relative humidity is above 50 percent unless required otherwise by manufacturer's instructions.
- C. Apply paints and finishes above minimum temperature conditions in strict accordance with manufacturer's instructions.
- D. Provide sufficient lighting to maintain 80 foot-candles measured mid-height at substrate surface.

July 11, 2018

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
 - 1. Paints and general finishes:
 - a. Benjamin Moore & Company, Montvale, NJ.
 - b. California Paints, Andover MA.
 - c. Glidden Professional (division of PPG Industries, Inc.), Strongsville, OH.
 - d. Devoe High Performance Coatings (division of PPG Industries, Inc.), Strongsville, OH.
 - e. Pittsburgh Paints / PPG Industries, Inc., Pittsburgh PA.
 - f. Pratt & Lambert Inc., (division of Sherwin Williams), Buffalo, NY.
 - g. Sherwin Williams, Cleveland OH.
 - 2. Interior stains and clear finishes for wood
 - a. Samuel Cabot, Inc., Boston MA.
 - b. PPG Architectural Finishes Inc., Olympic Home Care Products Division, Pittsburgh PA..

2.2 MATERIALS

- A. Coatings: Ready mixed, except for field catalyzed coatings with good flow and brushing properties; capable of drying or curing free of streaks or sags. Color pigments shall be processed to a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating. Provide best quality grade, where manufacturer makes more than one grade of any material specified.

2.3 ACCESSORIES

- A. Accessory materials: other materials not specifically indicated, but are required to achieve the finishes specified of commercial quality.
- B. Cleaning Materials: Tri-Sodium Phosphate (TSP) substitute. Acceptable products include the following, or approved equal:
 - 1. Savogran, Norwood MA, products "TSP-PF", or "Liquid TSP Substitute".
 - 2. Custom Building Products, Seal Beach, CA., product "Custom T.S.P. Substitute".
 - 3. DAP Inc., Baltimore MD., product "T.S.P. Substitute Heavy Duty Cleaner".

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Inspect all surfaces and verify that they are in proper condition to receive the work of this Section. Notify Contractor of any condition that may potentially affect proper application of coatings.

July 11, 2018

- B. Measure moisture content of surfaces, do not apply finishes unless moisture content of surfaces are below the following maximums:
 - 1. Gypsum board and joint treatment: 12 percent.
 - 2. Masonry or concrete: 12 percent.
 - 3. Interior wood: 15 percent.
 - 4. Exterior wood: 18 percent.
- C. Beginning Work of this Section means acceptance of existing substrate surfaces and site conditions.

3.2 PREPARATION

- A. Furnish and lay suitable drop cloths in all areas where coating work is being done to protect floors and all other surfaces from damage during the work. Protect adjoining surfaces with painters mask tape.
- B. Prior to preparing surfaces or finishing, remove all finish hardware for painting doors and frames, except hinges and locks on exterior door; remove electrical plates, light fixture trim and fittings. Re-install hardware and other removed items after painted surfaces are thoroughly dry.
- C. Mix coatings thoroughly, unless otherwise directed by the manufacturer of the specific coating used, to ensure uniformity of color and mass. Strain previously opened coatings to remove skins, lumps, and other foreign matter prior to painting.
- D. Thin or reduce materials only as recommended by the specific material manufacturer, and only with the approval of the Architect.
- E. Impervious surfaces: Remove mildew by scrubbing with solution of tri-sodium phosphate and bleach. Rinse with clean water and allow surface to thoroughly dry.
- F. Concrete and unit masonry surfaces scheduled to receive paint finish:
 - 1. Remove all loose scale and mortar, dirt, salt or alkali powder and other surface contaminates, using a detergent expressly formulated for cleaning of concrete and masonry.
 - 2. Remove oil and grease with a solution of tri-sodium phosphate.
 - 3. Remove stains caused by weathering corroding metals with a solution of sodium metasilicate after thoroughly wetting with water.
 - 4. Thoroughly rinse the cleaned surfaces with clear water, and allow the surfaces to completely dry, allow a minimum of 4 hours before commencing application of coatings.
- G. Uncoated steel and iron surfaces:
 - 1. Remove grease, scale, dirt, rust, and all foreign materials, down to bright metal by wire brushing, scraping, sanding, or sandblasting where heavy coatings of scale are evident.
 - 2. Wash steel with solvent, apply a treatment of phosphoric acid solution, ensuring weld joints, bolts and nuts are similarly cleaned.
 - 3. Spot prime after repairs with metal primer product of the finish coating manufacturer.

- H. Shop primed steel surfaces:
 - 1. Remove rust, blistered and defective shop prime paint, and all foreign materials, down to bright metal by wire brushing, scraping, sanding, or commercial paint remover. Feather edges to make touch-up patches inconspicuous.
 - 2. Remove all grease or dirt with mineral spirits.
 - 3. Spot prime bare metal with metal primer product of the finish coating manufacturer. Seal top and bottom edges of metals doors with primer.

- I. Previously painted steel surfaces:
 - 1. Remove rust, blistered and defective paint, down to bright metal by wire brushing, scraping, or sanding. Feather edges to make touch-up patches inconspicuous as possible
 - 2. Remove grease, dirt and all foreign materials.
 - 3. Spot prime bare metal with metal primer product of the finish coating manufacturer.

- J. New galvanized surfaces to receive field apply paint:
 - 1. Prepare surfaces in accordance with SSPC-SP16 to achieve a surface profile of 0.5 to 1.5 mils.

- K. Aluminum surfaces scheduled for paint finish:
 - 1. Remove surface contamination by steam or high pressure water.
 - 2. Remove oxidation with acid etch and solvent washing.
 - 3. Apply etching primer immediately following cleaning.

- L. New interior wood items scheduled to receive paint (opaque) finish.
 - 1. Smooth minor defects and remove all foreign matter by sanding, and if necessary, steel wool.
 - 2. Wash sap spots and knots with mineral spirits. When dry, touch up knots, pitch streaks, and sappy sections with commercial stain sealer.
 - 3. Fill up nail holes and cracks with wood putty or plastic wood after primer of first coat of finish is dry, and sand smooth.

- M. Existing interior wood items scheduled to receive paint finish.
 - 1. Smooth minor defects by sanding. Remove all foreign matter with mineral spirits and fine sandpaper or steel wool.
 - 2. Touch up knots and pitch streaks with commercial stain sealer.
 - 3. Fill up nail wood defects, chips in layers of paint, and cracks with spackle. Ease edges of existing paint by application of spackle and sanding smooth.

- N. New exterior wood scheduled to receive paint finish.
 - 1. Smooth minor defects by sanding and/or by the use of steel wool. Remove all foreign matter with commercial paint remover and fine sandpaper.
 - 2. Treat wood with a dip or heavy flood coat of Water Repellant Wood Preservative, allow to dry. Touch up knots, pitch streaks, and sappy sections with commercial stain sealer.

3. Fill up nail holes and cracks with wood putty or plastic wood after primer of first coat of finish is dry, and sand smooth.
- O. Existing exterior wood clapboards and trim scheduled to receive paint finish.
1. Scrape surfaces to remove loose, peeling and chipped paint. Sand only to ease edges and roughen existing paint surfaces.
 2. Wash all with a solution of TSP substitute (phosphate free), and rinse surfaces well.
 3. Remove all remaining foreign matter, use commercial paint remover, if deemed necessary. Thoroughly neutralize paint remover as recommended by manufacturer. Allow wood to dry (15 percent moisture content maximum) and sand affected surfaces smooth.
 4. Touch up knots, pitch streaks, and sappy sections with two coats commercial exterior stain sealer, "Kilz" or equal.
 5. Fill up nail holes, wood defects, chips in layers of paint, and cracks with exterior wood putty or plastic wood after primer of first coat of finish is dry, and sand smooth.
- P. Gypsum board surfaces, new and existing: Fill minor defects with latex based spackle. Spot-seal all compound surfaces and repair areas in gypsum board, with specified first coat material before application of the first coat.
- Q. Apply all materials in strict accordance with the approved manufacturer's printed instruction, and in accordance with the best trade practices. Each coat shall be reviewed and approved by the Architect before succeeding coats are applied.
- R. Do not apply successive coating until the preceding coat is thoroughly dry, and in no case in less than 24 hours after the preceding coat.
- S. Number of coats is indicated under Painting Schedules. Number of coats is indicated as a minimum number to be applied over scheduled substrates. An additional coat or coats may be required for proper color coverage of substrate as determined by the Architect, at no additional cost to the Owner. Examples of these conditions include, but are not limited to:
1. Dark colored substrates may require an additional primer or intermediate coat to stabilize color, if final applied top-coat color is light.
 2. Pre-finished or pre-primed products may require an additional field applied coat to stabilize the shop/factory applied base color prior to application of top-coat finishes.
 3. Dark color top coat finishes may require additional finish coat over white or light colored substrates to obtain correct color density.
- T. Apply each coat to a uniform finish; Apply primer and first coat of slightly lighter in color tint than the scheduled color of the final coat.
- U. Sand lightly between coats to achieve required finish and remove sanding dust prior to applying succeeding coat.
- V. Where clear finishes are required, tint fillers to match wood. Work fillers into the grain before set. Wipe excess from surface.

July 11, 2018

- W. Prime back surfaces of all interior and exterior woodwork scheduled for painted finish with primer.
- X. Prime back surfaces of interior woodwork scheduled to receive stain or varnish finish with gloss varnish reduced 25 percent with mineral spirits.

3.3 APPLICATION – CONCRETE MASONRY

- A. Apply block filler to concrete masonry partitions at maximum rate allowed by coating manufacturer. Apply by airless spray followed by back rolling to force material into voids. Use a squeegee to remove excess material prior to initial set, and provide a smooth surface texture. After initial set, touch-up and fill apparent voids and holidays with fresh material.

3.4 CLEANING

- A. Upon completion of the work in each area, remove all coating splatters from glass, prefinished surfaces, bright metals, and from other surfaces that have not been painted or finished hereunder. Do not use abrasive paper or abrasive cleaner on any prefinished surface or bright metal. Remove all materials and debris; leave work area in a clean condition.

3.5 PROTECTION AND TOUCH-UP

- A. During painting work, protect the work of other trades against undue soilage and damage by the exercise of reasonable care and precautions. Properly clean, repair or replace any work so damaged and soiled.
- B. Protect all painted and finished surfaces against damage until the date of final acceptance of the work. The Architect will conduct a final review of all work performed hereunder. Re-coat or touch-up, all scratches and other blemishes on surfaces, and as directed by the Architect, any areas found which do not comply with the requirements of this Section, and bear all costs therefore.
- C. Any re-coating or touch-up work, required after the work of this Section has been reviewed and accepted by the Architect, will be paid for by the Contractor.

3.6 PAINTING SCHEDULE

- A. Colors: The Architect will furnish a schedule of colors for each area and surface. Tinting and matching shall be to the satisfaction of the Architect. No limit is placed on the number of colors that may be required, or the number of colors in any one room, area, or surface. Premium paints of deep-hued, bright, pigment intensive, accent and primary colors may be scheduled for up to 25 percent of all interior and exterior surfaces without additional cost to the Owner.
 - 1. Colors of priming coats (and body coats where specified) shall be lighter in tint than those of finish coat.
 - 2. Colorants: Pure, non-fading pigments, mildew-proof, ultra-violet resistant, finely ground in approved medium; and be limeproof, when used in coatings to be applied on masonry, concrete, plaster, and gypsum board surfaces.
- B. Paint schedule for exterior surfaces and materials: Refer to Document 09 91 13.
- C. Paint schedule for interior surfaces and materials: Refer to Document 09 91 23.

July 11, 2018

POPE'S TAVERN
ADDITION/RENOVATION
Halifax, Massachusetts

- D. Paint schedule for labeling and identifying fire resistive and rated designations :
Refer to Document 09 91 23.

- E. Painting schedule for mechanical and electrical equipment: Refer to Document
09 91 23.

End of Section

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Document 09 91 13
EXTERIOR PAINTING SCHEDULE
(FILED SUB-BID REQUIRED AS PART OF SECTION 09 00 09)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Sub-Bid Requirements: As provided under Section 09 00 09 - PAINTING FILED SUB-BID REQUIREMENTS and supplemented under the Bidding Requirements, Contract Forms, and Conditions of the Contract, and applicable parts of Division 1 - GENERAL REQUIREMENTS.
 - 1. Work of this Filed Sub-Bid includes all individual specification sections listed in Section 09 00 09.
- B. General: Number of coats scheduled herein below is minimum required, refer to Article entitled "APPLICATION" in specification Section 09 91 00 - PAINTING, regarding coverage.

1.2 PAINTING SCHEDULE FOR EXTERIOR SURFACES AND MATERIALS

- A. Exterior METAL, FERROUS, new, shop primed and existing:
 - 1. One coat rust inhibitive primer. (touch up bare metal at existing and shop primed surfaces).
 - a. California: "Everlife Oil-based Metal Primer, N°. 21150.
 - b. Devoe Coatings: Devguard 4160 Multi-Purpose Tank & Structural Primer.
 - c. Moore: "Universal Metal Primer" N°. P07.
 - d. Pittsburgh: "Speedhide Industrial Rust Inhibitive Primers", 7-852 Series .
 - e. Sherwin-Williams: "Kem Kromik Universal Metal Primer", B50Z Series.
 - 2. Two coats acrylic gloss enamel:
 - a. California: "Everlife 100% Acrylic Waterborne High Gloss ", N°. 521..
 - b. Devoe Coatings: Devflex 4208QD Waterborne Gloss Enamel.
 - c. Moore: "Acrylic Gloss Enamel", N°. P28
 - d. Pittsburgh: "Pitt-Tech DTM Exterior Waterborne High Gloss Enamel", 90-300 Series.
 - e. Sherwin-Williams: "DTM Acrylic Gloss", B66 Series
- B. Exterior METAL, RAILINGS, galvanized (handrails and guardrails) to receive - high gloss finish:
 - 1. Touch-up cold galvanizing paint.
 - 2. One coat of epoxy primer (dry film coat 3.0 to 4.0 mils)
 - a. California: No equivalent.
 - b. Devoe Coatings: Devran 201H Universal Epoxy Primer.
 - c. Moore: "Superspec HP Epoxy Metal Primer", P33 Series.
 - d. Pittsburgh: "Aquapon WB Epoxy Metal Primer", 98 Series

- e. Sherwin-Williams: "Heavy Duty Epoxy", B67 Series / B60 V 3 @ 3 mils DFT.
- 3. Two coats of gloss finish epoxy coating (dry film coat 1.5 to 2.0 mils).
 - a. California: No equivalent.
 - b. Devoe Coatings: Devthane 359 DTM High Build Aliphatic Urethane Gloss Enamel @ 2.0 -3.0 mils DFT.
 - c. Moore: "Superspec HP Aliphatic Acrylic Urethane", P74 Series.
 - d. Pittsburgh: "Pitt-Thane Ultra Urethane Enamel", 95-812 Series.
 - e. Sherwin-Williams: "Hi-Solids Polyurethane-Low VOC", B65 Series/B60 V 30 @ 3.5 mils DFT.
- C. Exterior factory-primed mineral fiber cement siding and trim:
 - 1. Touch-up primer: As recommended by the manufacturer of mineral fiber cement siding, specified in Section 07 46 46 - MINERAL FIBER CEMENT SIDING.
 - 2. Two coats 100-percent-acrylic satin paint:
 - a. California: "2010 Acrylic Latex Exterior Eggshell Finish", N°. 401.
 - b. Glidden Professional: Fortis 450 Exterior N°. 6203V.
 - c. Moore: "Aura Exterior Low Lustre", N°. 634.
 - d. Pittsburgh: "Manor Hall Timeless – Satin", 73-410 Series.
 - e. Sherwin-Williams: "Duration - Satin".
- D. Exterior WOOD CLAPBOARDS:
 - 1. One Coat Primer: enamel primer.
 - a. California: "Troubleshooter Universal Wood Primer", N°. 21700.
 - b. Glidden Professional: Stain Stomper Exterior Primer Sealer N°. 2110.
 - c. Moore: "Moorwhite Primer", N°. 100.
 - d. Pittsburgh: "Speedhide Exterior Alkyd Wood Primer", 6-9 Series.
 - e. Sherwin-Williams: "A-100 Alkyd Exterior Wood Primer", Y24 W 20.
 - 2. Two coats 100-percent-acrylic satin paint:
 - a. California: "2010 Acrylic Latex Exterior Eggshell Finish", N°. 401.
 - b. Glidden Professional: Fortis 450 Exterior N°. 6203V.
 - c. Moore: "Aura Exterior Low Lustre", N°. 634.
 - d. Pittsburgh: "Manor Hall Timeless – Satin", 73-410 Series.
 - e. Sherwin-Williams: "Duration - Satin".
- E. Exterior WOOD TRIM, windows and doors, new, primed and previously painted:
 - 1. One coat 100%-acrylic latex primer at bare wood. (Touch up primed and previously painted surfaces)
 - a. California: "Fres-Coat Trouble-Shooter 100% Acrylic Latex Primer", N°. 45100/45101.
 - b. Glidden Professional: Stain Stomper Exterior Primer Sealer N°. 2110.
 - c. Moore: "Moore Fresh Start All Purpose 100% Acrylic Primer", N°. 023.

July 11, 2018

POPE'S TAVERN
ADDITION/RENOVATION
Halifax, Massachusetts

- d. Pittsburgh: "Sun-Proof Exterior House & Trim Latex Wood Primer", 72-1 Series.
 - e. Sherwin-Williams: "A100 Exterior Latex Wood Primer", B42W41 Series.
2. Two coats latex satin paint:
- a. California: "Acrylic Latex House Paint", N°. 471.
 - b. Glidden Professional: Ultra-Hide 150 Exterior Satin N°. 2412V.
 - c. Moore: "Ultra Spec EXT Paint, Satin Finish", N448 Series.
 - d. Pittsburgh: "Speedhide Exterior Acrylic Satin", 6-2045 Series.
 - e. Sherwin-Williams: "A-100 Exterior Latex Satin House and Trim Paint" A82 Series.

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Document 09 91 23
INTERIOR PAINTING SCHEDULE
(FILED SUB-BID REQUIRED AS PART OF SECTION 09 00 09)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Sub-Bid Requirements: As provided under Section 09 00 09 - PAINTING FILED SUB-BID REQUIREMENTS and supplemented under the Bidding Requirements, Contract Forms, and Conditions of the Contract, and applicable parts of Division 1 - GENERAL REQUIREMENTS.
 - 1. Work of this Filed Sub-Bid includes all individual specification sections listed in Section 09 00 09.
- B. General: Number of coats scheduled herein below is minimum required, refer to Article entitled "APPLICATION" in specification Section 09 91 00 - PAINTING, regarding coverage.

1.2 PAINTING SCHEDULE FOR INTERIOR SURFACES AND MATERIALS

- A. Interior GYPSUM BOARD (drywall) partitions, previously painted:
 - 1. Two coats latex eggshell paint:
 - a. California: "CalPro2000 Series Acrylic Eggshell", N°. 557.
 - b. Glidden Professional: Ultra-Hide 250 Eggshell N°. 1402.
 - c. Moore: "SuperSpec Latex Eggshell Enamel", N°. 274.
 - d. Pittsburgh: "Speedhide Latex Eggshell Enamel", 6-411 Series.
 - e. Sherwin-Williams: " ProMar 200 Zero VOC Interior Latex Eg-Shel", B20-2600 Series.
- B. Interior GYPSUM BOARD (drywall) partitions:
 - 1. One coat latex primer.
 - a. California: "Prime Touch Primer Sealer" N°s. 545.
 - b. Glidden Professional: PVA Wall Primer Sealer N°. 1030.
 - c. Moore: "Superspec Primer", N°. 253.
 - d. Pittsburgh: "Speedhide Interior Quick Drying Latex Sealer", 6-2 Series.
 - e. Sherwin-Williams: "ProMar 200 Zero VOC Interior Latex Primer", B28w2600 Series.
 - 2. Two coats latex eggshell paint:
 - a. California: "CalPro2000 Series Acrylic Eggshell", N°. 557.
 - b. Glidden Professional: Ultra-Hide 250 Eggshell N°. 1402.
 - c. Moore: "SuperSpec Latex Eggshell Enamel", N°. 274.
 - d. Pittsburgh: "Speedhide Latex Eggshell Enamel", 6-411 Series.
 - e. Sherwin-Williams: " ProMar 200 Zero VOC Interior Latex Eg-Shel", B20-2600 Series.

- C. Interior GYPSUM BOARD (drywall) ceilings, and underside of soffits, previously painted:
 - 1. Two coats latex flat paint:
 - a. California: "CalPro2000 Series Acrylic Flat", N°. 556.
 - b. Glidden Professional: Ultra-Hide 250 Flat N° 1200.
 - c. Moore: "Waterborne Ceiling Paint", 508 Series.
 - d. Pittsburgh: "Speedhide Latex Interior Flat Wall Paint", 6-70 Series.
 - e. Sherwin-Williams: "ProMar 200 Int. Latex Flat Wall Paint" Series.

- D. Interior GYPSUM BOARD (drywall) ceilings, and underside of soffits:
 - 1. One coat latex primer.
 - a. California: "Prime Touch Primer Sealer", N°s. 545.
 - b. Glidden Professional: PVA Wall Primer Sealer N°. 1030.
 - c. Moore: "Fresh Start All Purpose Primer", No. 046.
 - d. Pittsburgh: "Speedhide Interior Quick Drying Latex Sealer", 6-2 Series.
 - e. Sherwin-Williams: "ProMar 200 Zero VOC Interior Latex Primer", B28w2600 Series.
 - 2. Two coats latex flat paint:
 - a. California: "CalPro2000 Series Acrylic Flat", N°. 556.
 - b. Glidden Professional: Ultra-Hide 250 Flat N° 1200.
 - c. Moore: "Waterborne Ceiling Paint", 508 Series.
 - d. Pittsburgh: "Speedhide Latex Interior Flat Wall Paint", 6-70 Series
 - e. Sherwin-Williams: "ProMar 200 Int. Latex Flat Wall Paint Series".

- E. Interior gypsum board (drywall) partitions at kitchen, and elsewhere scheduled for epoxy finish:
 - 1. One coat of sealer,
 - a. California: "Prime Choice ASAP Primer", N°. 50300.
 - b. Glidden Professional: Gripper Primer N°. 3210.
 - c. Moore: "SuperSpec Primer", N°. 253.
 - d. Pittsburgh: "Speedhide Interior Quick Drying Latex Sealer", 6-2 Series.
 - e. Sherwin-Williams: "ProMar 200 Zero VOC Interior Latex Primer", B28w2600 Series.
 - f. Tnemec: PVA 51-792 Sealer.
 - 2. Two coats of semi-gloss Water Based Acrylic-Epoxy Coatings (3 mils DFT each coat).
 - a. California: No equivalent.
 - b. Devoe Coatings: "Tru-Glaze-WB" 4418 Waterborne Acrylic Epoxy Coating.
 - c. Moore: "Corotech WB Amine Epoxy Semi-Gloss", N°. V440.
 - d. Pittsburgh: "Pitt-Glaze Water Based Acrylic Epoxy Enamels", 16 Series.
 - e. Sherwin-Williams: "Water Based Catalyzed Epoxy" B70/B60V15 Series.

- f. Tnemec: "Tneme-Tufcoat", N°. 112.
- F. Interior METAL, FERROUS, excluding railings, to receive semi-gloss finish:
(includes galvanized metal doors and frames):
 - 1. One coat of rust prohibitive primer for unfinished metal surfaces, and touch up bare metal at shop primed, existing and previously coated surfaces:
 - a. California: "Rust-Stop DTM Primer/Finish", N°. 1061.
 - b. Devoe Coatings: Devflex 4020PF DTM Primer and Flat Finish.
 - c. Moore: "Acrylic Metal Primer", N°. P04.
 - d. Pittsburgh: "Pitt-Tech DTM Primer/Finish 100% Acrylic", 90-709/712 Series
 - e. Sherwin-Williams: "DTM Acrylic Primer Finish", B66 W1 Series.
 - 2. Two coats acrylic semi-gloss enamel:
 - a. California: "Rust-Stop DTM Primer/Finish", N°. 1061.
 - b. Devoe Coatings: Devflex 4216HP High Performance Waterborne Acrylic Semi-Gloss Enamel.
 - c. Moore: "Ultra Spec 500 DTM Acrylic Semi-Gloss", N°. HP29.
 - d. Pittsburgh: "Pitt-Tech Plus High Performance, Semi -Gloss DTM Industrial Enamel", 90-1210 Series.
 - e. Sherwin-Williams: "Sher-Cryl HPA Semi-Gloss", B66 Series.
- G. Interior METAL, GALVANIZED, (includes exposed ductwork):
 - 1. Touch-up with metal primer.
 - a. California: "Rust-Stop DTM Primer/Finish", N°. 1061.
 - b. Devoe Coatings: Devflex 4020PF DTM Primer and Flat Finish.
 - c. Moore: "Acrylic Metal Primer", N°. P04.
 - d. Pittsburgh: "Pitt-Tech DTM Primer/Finish 100% Acrylic", 90-709/712 Series.
 - e. Sherwin-Williams: "DTM Acrylic Primer Finish" B66 W1 Series.
 - 2. Two coats acrylic semi-gloss enamel:
 - a. California: "Rust-Stop DTM Primer/Finish", N°. 1061.
 - b. Devoe Coatings: Devflex 4216HP High Performance Waterborne Acrylic Semi-Gloss Enamel.
 - c. Moore: "Ultra Spec 500 DTM Acrylic Semi-Gloss", N°. HP29.
 - d. Pittsburgh: "Pitt-Tech Plus High Performance, Semi -Gloss DTM Industrial Enamel", 90-1210 Series.
 - e. Sherwin-Williams: "Sher-Cryl HPA Semi-Gloss", B66 Series.
- H. Interior exposed METAL, PIPING: Same as specified for ferrous metal.
- I. Interior METAL, RAILINGS (handrails and guardrails):
 - 1. One coat of rust prohibitive primer for unfinished metal surfaces, and touch up bare metal at shop primed, existing and previously coated surfaces:
 - a. California: "Rust-Stop DTM Primer/Finish", N°. 1061.

- b. Devoe Coatings: Devflex 4020PF DTM Primer and Flat Finish.
 - c. Moore: "Acrylic Metal Primer", N°. P04.
 - d. Pittsburgh: "Pitt-Tech DTM Primer/Finish 100% Acrylic", 90-709/712 Series
 - e. Sherwin-Williams: "DTM Acrylic Primer Finish", B66 W1 Series.
2. Two coats of gloss finish epoxy coating (dry film coat 1.5 to 2.0 mils).
- a. California: "Rust-Stop DTM Primer/Finish", N°. 1061.
 - b. Devoe Coatings: Devflex 659 Gloss DTM Waterborne Acrylic Enamel.
 - c. Moore: "Super Spec HP DTM Gloss Enamel", N°. P28.
 - d. Pittsburgh: "Pitt-Tech High Performance, High -Gloss DTM Industrial Enamel", 90-374 Series.
 - e. Sherwin-Williams: "Sher-Cryl HPA", B66 Series".
- J. Interior WOOD DOORS, shop primed and previously painted to receive painted (opaque) finish:
1. Touch up bare wood with acrylic enamel primer-sealer (undercoater):.
- a. California: "Wipe-Out 100% Acrylic Latex Stain Block", N° 52500.
 - b. Glidden: Wall and Woodwork Primer Sealer, N° 1020.
 - c. Moore: "Alkyd Enamel Underbody", N°. 217.
 - d. Pittsburgh: "Speedhide Alkyd Interior Quick-Drying Enamel Undercoater", 6-6 Series.
 - e. Sherwin-Williams: "Wall and Wood VOC Primer", B49 WZ2 Series.
2. Two coats acrylic semi-gloss enamel:
- a. California: "Fres-Coat Unite Semi-Gloss", N°. 563.
 - b. Glidden Professional: Ultra Hide 150 Semi-Gloss N°. 1416.
 - c. Moore: "Superspec Latex Semi Gloss", 276 Series.
 - d. Pittsburgh: "Speedhide Interior Semi-Gloss", N°. 6-55.
 - e. Sherwin-Williams: "ProClassic Waterborne", B31W20 Series.
- K. Interior WOOD TRIM, new, unfinished, to receive painted (opaque) finish:
1. One coat acrylic primer-sealer (undercoater):
- a. California: "Wipe-Out 100% Acrylic Latex Stain Block", N° 52500.
 - b. Glidden: Wall and Woodwork Primer Sealer, N° 1020.
 - c. Moore: "Alkyd Enamel Underbody", N°. 217.
 - d. Pittsburgh: "Speedhide Alkyd Interior Quick-Drying Enamel Undercoater", 6-6 Series.
 - e. Sherwin-Williams: "PrepRite Classic Latex Primer", B28W200 Series.
2. Two coats acrylic semi-gloss enamel:
- a. California: "Fres-Coat Unite Semi-Gloss", N°. 563.
 - b. Glidden Professional: Ultra Hide 150 Semi-Gloss N°. 1416.
 - c. Moore: "Superspec Latex Semi Gloss", 276 Series.
 - d. Pittsburgh: "Speedhide Interior Semi-Gloss", 6-500 Series.

- e. Sherwin-Williams: "ProClassic Waterborne", B31W20 Series.
- L. Interior WOOD TRIM, shop primed and previously painted, to receive painted (opaque) finish:
 - 1. Touch up bare wood with acrylic primer-sealer (undercoater):
 - a. California: "Wipe-Out 100% Acrylic Latex Stain Block", N° 52500.
 - b. Glidden: Wall and Woodwork Primer Sealer, N° 1020.
 - c. Moore: "Alkyd Enamel Underbody", N°. 217.
 - d. Pittsburgh: "Speedhide Alkyd Interior Quick-Drying Enamel Undercoater", 6-6 Series.
 - e. Sherwin-Williams: "PrepRite Classic Latex Primer", B28W200 Series.
 - 2. Two coats acrylic semi-gloss enamel:
 - a. California: "Fres-Coat Unite Semi-Gloss", N°. 563.
 - b. Glidden Professional: Ultra Hide 250 Semi-Gloss N°. 1406.
 - c. Moore: "Superspec Latex Semi Gloss", 276 Series.
 - d. Pittsburgh: "Speedhide Interior Semi-Gloss", 6-500 Series.
 - e. Sherwin-Williams: "ProClassic Waterborne", B31W20 Series.

1.3 PAINTING SCHEDULE FOR FIRE RESISTIVE AND RATED DESIGNATIONS

- A. In compliance with Massachusetts State Building Code, Ninth Edition (referencing Section 703.6 of the 2015 International Building Code) and as additionally specified herein, provide identification for all fire walls, fire barriers, fire partitions, smoke barriers and smoke partitions and any other wall or partition which is required to have protected openings or penetrations.
 - 1. Application:
 - a. Apply to outside of fire rated shafts, and to both sides of partitions at intervals not to exceed 30'-0" for entire length of partition or wall, or once on any partition 30'-0 feet or less in length.
 - b. Locate identification in all accessible concealed floor, floor-ceiling and attic spaces. Locate identification within 12 to 18 inches above finished ceilings.
 - c. Apply stenciled lettering by spray or brush, or provide permanent signage. Identification shall be waterproof, fade-proof and non-combustible. Signage shall be mechanically fastened or permanently adhered to partition.
 - d. Stencil character height: 1 inch minimum.
 - e. Color: Easily identifiable color, contrasting with background, acceptable to Owner.
 - 2. Apply stenciled lettering to the following types of partitions using wording specified:
 - a. Applied identification for 2 hour fire rated partitions shall read: "2 HOUR FIRE WALL - PROTECT ALL OPENINGS".
 - b. Applied identification for 1 hour fire rated partitions shall read: "1 HOUR FIRE WALL - PROTECT ALL OPENINGS".

- c. Applied identification for Smoke barriers shall read: "1 HOUR SMOKE BARRIER - PROTECT ALL OPENINGS".
- d. Applied identification for Smoke partitions shall read: "SMOKE BARRIER PARTITION - PROTECT ALL OPENINGS".

1.4 PAINTING SCHEDULE FOR MECHANICAL AND ELECTRICAL EQUIPMENT

- A. Paint interior surfaces of air ducts, and convector and baseboard heating cabinets that are visible through grilles and louvers with one coat of flat black enamel.
- B. Paint dampers exposed behind louvers, grilles, and convector and baseboard cabinets to match face panels.
- C. Remove unfinished louvers, grilles, covers and access panels on and paint as scheduled above.
- D. Plywood backboards for electrical panels and other equipment. Paint both front and back surfaces and all edges of plywood backboards before backboards are installed.
 - 1. One coat latex primer-sealer (undercoater):
 - a. Glidden Professional: Lifemaster No VOC Primer N°. 9116.
 - b. Moore: "EcoSpec Interior Latex Primer Sealer" 231.
 - c. Pittsburgh: "Pure Performance Interior Latex Primer".
 - d. Sherwin-Williams: "Harmony Interior Latex Primer" B11W900.
 - 2. Two coats latex semi-gloss paint:
 - a. Glidden Professional: Lifemaster No VOC Semi-Gloss" N°. 9200.
 - b. Moore: "EcoSpec Interior Latex Semi-gloss" N°. 224.
 - c. Pittsburgh: "Pure Performance Interior Semi-gloss", 9-500 Series.
 - d. Sherwin-Williams: "Harmony Interior Latex Semi-gloss" B10 Series.
- E. Prime and paint insulated and exposed cold pipes, conduit, electrical boxes, insulated and exposed ducts, hangers, brackets, collars and supports, except where items are located in storage, mechanical or equipment spaces or those items which are factory prefinished.
- F. Exposed to view un-insulated hot pipes within finished painted areas: Two coats heat-resistant enamel conforming to Federal Specification TT-E-496, Type I, applied when surfaces are less than 140 degrees Fahrenheit.

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Section 10 28 13
TOILET ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish and install toilet, bath and custodial accessories.
- B. Furnish concealed anchorage devices for handicap handrails for installation under Section 06 10 00 - ROUGH CARPENTRY.
- C. Furnish toilet and bath accessory templates, to locate anchorage reinforcement, to trades responsible.

1.2 RELATED REQUIREMENTS

- A. Section 06 10 00 - ROUGH CARPENTRY:
 - 1. Wood blocking.
 - 2. Installation of concealed anchorage devices for grab bars in toilet rooms:
Section 10 28 13 - TOILET ACCESSORIES.
- B. Section 09 29 00 - GYPSUM BOARD: Gypsum board partitions and metal framing.
- C. Section 09 30 00 - TILING: tiled walls as substrate for toilet accessories.
- D. Section 10 21 13 - TOILET COMPARTMENTS.

1.3 REFERENCES

- A. Referenced Standards: Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. The standards referenced herein are included to establish recognized minimum quality only. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern. Equivalent quality and testing standards will be acceptable, subject to their timely submission, review and acceptance by the Architect.
 - 1. ANSI A 117.1 - Specifications for Making Buildings and Facilities Accessible To and Usable by Physically Handicapped People.
 - 2. ASTM A 123 - Zinc Coatings on Products Fabricated from Rolled, Pressed, and Forged Steel, Shapes, Plates, Bars and Strips.
 - 3. ASTM A 167 - Stainless and Heat-Resisting Chromium-Nickel Steel, Plate, Sheet and Strip.
 - 4. ASTM A 269 - Seamless and Welded Austenitic Stainless Steel Tubing for General Service.
 - 5. ASTM A 366 - Steel, Carbon, Cold-Rolled Sheet, Commercial Quality.
 - 6. ASTM A 386 - Zinc Coating on Assembled Steel Products.
 - 7. ASTM B 456 - Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium.

July 11, 2018

1.4 SUBMITTALS

- A. Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
1. Literature: Manufacturer's product data sheets, for each item furnished hereunder.
 2. Schedule: Complete schedule, indicating types, quantity, and model numbers of accessories for each location in which the accessories will be installed.
 3. Selection samples: Sample color chips indicating each manufacturer's full range of colors available for selection by Architect.
 4. Verification samples: Complete units, as requested by Architect.

1.5 REGULATORY REQUIREMENTS

- A. Conform to applicable codes and accessibility regulations, and comply with ANSI A 117.1 for installation of work.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials in original packages, containers or bundles bearing brand name, identification of manufacturer or supplier and item identification number corresponding with approved schedule.
- B. Store materials inside, under cover, and in manner to keep them dry, protected from weather, surface contamination, corrosion and damage from construction traffic and other causes.

1.7 SEQUENCING AND SCHEDULING

- A. Coordinate the work of this Section with placement of internal wall reinforcement and reinforcement of toilet partitions to receive anchor attachments.
- B. Coordinate the work of this Section with placement of internal wall reinforcement.

1.8 WARRANTY

- A. Deliver to the Owner upon completion of the work of this Section, applicable manufacturer's standard warranties.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Specified Manufacturer: To establish a standard of quality, design and function desired, Drawings and specifications have been based on Bobrick Washroom Equipment, Inc., North Hollywood CA., referred to as "Bobrick."
- B. Acceptable Manufactures and models: To establish a standard of quality, design, function desired, and appearance, Drawings and specifications have been based on manufacturers and model numbers specified herein below. Manufacturers offering products which may be considered as equal include the following:
1. A&J Washroom Accessories, Inc., (A&J) New Windsor NY.
 2. American Specialties, Inc. (ASI), Yonkers NY.

July 11, 2018

3. Bobrick Washroom Equipment, Inc. (Bobrick), Clifton Park NY.
4. Bradley Corporation / Washroom Accessories Division, (Bradley) Menomonee Falls, WI.

2.2 MATERIALS

- A. Sheet steel: Cold rolled, commercial quality, ANSI/ASTM A 366.
- B. Stainless steel sheet: ASTM A 167, Type 302/304.
- C. Tubing: ASTM A 269 stainless steel.
- D. Plastic laminate: NEMA LD-3, general purpose type; 0.125-inch thick, matte finish in color as selected by the Architect.

2.3 TOILET ACCESSORIES

- A. Coat/robe hook: Surface mounted satin finish stainless steel double robe hook, fabricated from 22 gage type 304 stainless steel, protrudes from wall nominally 1-7/8 inches.
 1. A&J, model N°. UX112-SF.
 2. ASI model N°. 7345-S.
 3. Bobrick model N°. B-76727.
 4. Bradley model N°. (n/a).
- B. Coat/robe hook Locations:
 1. Provide one hook on the toilet side of all doors to all toilet rooms.
- C. Grab bars (of lengths and configurations as indicated on Drawings): Stainless steel, minimum wall thickness 18 gage (Stub's gage), with non-slip knurled, peened or striated surface.
 1. Grab Bar Loading Criteria as defined in Commonwealth of Massachusetts Regulation 521 CMR: *Architectural Access Board*.
 - a. Bending stress in a grab bar induced by the maximum bending moment from the application of 250 lbs. shall be less than the allowable stress for the material of the grab bar.
 - b. Shear stress induced in a grab bar by the application of 250 lbs. shall be less than the allowable shear stress for the material of the grab bar. If the connection between the grab bar and its mounting bracket or other supports is considered to be fully restrained, then direct and torsional shear stresses shall be totaled for the combined shear stress, which shall not exceed the allowable shear stress.
 - c. Shear force induced in a fastener or mounting device from the application of 250 lbs. shall be less than the allowable lateral load of either the fastener or mounting device or the supporting structure, whichever is the smaller allowable load.
 - d. Tensile force induced in a fastener by direct tension force of 250 lbs. plus the maximum moment from the application of 250 lbs. shall be less than the allowable withdrawal load between the fastener and the supporting structure

- e. Grab bars shall not rotate within their fittings.
- 2. Grab bars: 1-1/4 inch diameter with satin finished ends, concealed 1/8 inch thick mounting flange with snap-on cover, equal to:
 - a. A&J model N°. UG2.
 - b. ASI series 3700.
 - c. Bobrick series B-5806.99
 - d. Bradley series 832.
- D. Mop and broom holders: Surface mounted, nominal 34 inch long stainless steel unit with 18 gage 8 inch deep continuous shelf, 4 stainless hooks and 3 mop/broom holders, anti-slip spring loaded, rubber cam mop holders, capable of holding 7/8 to 1-1/4 inch diameter handles.
 - 1. A&J model N°. UJ45A.
 - 2. ASI model N°. 1308-3.
 - 3. Bobrick model N°. B-239-34.
 - 4. Bradley model N°. 9933.
- E. Sanitary napkin disposal: Surface mounted feminine napkin disposal unit, fabricated of type 304 stainless steel, with one piece cover.
 - 1. A&J, model N°. U582.
 - 2. ASI model N°. 0473-1A.
 - 3. Bobrick Contura Series B-254.
 - 4. Bradley model N°. 4722-15.
- F. Shelving: Custodial shelf, stainless steel, 6 inches deep by 24 inches wide with 3/4 inch edge return. Mounting brackets, 16 gage welded to shelf.
 - 1. A&J model N°. U776.
 - 2. A.S.I. model N°. 0692-624.
 - 3. Bobrick model N°. B-296x24.
 - 4. Bradley model N°. 756.
- G. Soap dispenser: Lavatory mounted lather type soap dispenser, with stainless steel piston and 4 inch spout, translucent shatter-resistant polyethylene container, minimum 32 fluid ounce capacity.
 - 1. A&J model N°. U128PCA.
 - 2. ASI model N°. 0322-D.
 - 3. Bobrick model N°. B-822
 - 4. Bradley model N°. 6326-68 (32 oz capacity)
- H. Soap dispensers: Surface mounted for viscous free flowing soaps, with lockable 40 fluid ounce stainless steel container, and corrosion resistant all purpose valve for liquid soaps, lotions and detergents which will operate with less than 5 pounds of force.
 - 1. A&J model N°. U124.
 - 2. ASI model N°. 9343.

July 11, 2018

3. Bobrick 'Contura' Series, model N°. B-4112.
 4. Bradley model N° 6542.
- I. Toilet tissue dispenser, double roll type: Surface-mounted toilet tissue dispenser with cast aluminum bracket, molded and extruded ABS spindles, vandelproof keyed locking mechanism, able to accommodate two 2000 sheet rolls.
 1. A&J model N°. U806.
 2. ASI model N°. 0264-1.
 3. Bobrick model N°. B-2740.
 4. Bradley model N°. 5241.
 - J. Towel dispenser, recessed paper towel dispenser with stainless steel door and cabinet, welded construction having a minimum capacity of 300 C-Fold towels or 400 multi-fold towels.
 1. A&J model N°. U2324.
 2. ASI model N°. 9457.
 3. Bobrick model N°. B-35903.
 4. Bradley model N°. 2442.
 - K. Towel dispenser & waste receptacle units: Surface mounted stainless steel paper towel dispenser and waste receptacle. Paper towel dispenser shall dispense 600 C-fold or 800 multifold paper towels without any additional adapters. Waste receptacle shall be furnished with removable, leak-proof, rigid molded plastic waste container. Waste capacity: 12 gallons minimum.
 1. A&J model N°. 650-SM (having waste capacity of 12.0 gallons).
 2. ASI model N°. 20469-9 (having waste capacity of 14.8 gallons).
 3. Bobrick model N°. B-3949 (having waste capacity of 14.2 gallons).
 4. Bradley model N°. 237-11.
- 2.4 LOCKS
- A. General: All locks shall be keyed alike. Provide four (4) keys, for lockable accessories, to the Owner.
- 2.5 INSTALLATION ACCESSORIES
- A. Fasteners, screws, and bolts: Hot dip galvanized, tamperproof.
 - B. Expansion shields: Fiber, lead or rubber as recommended by accessory manufacturer for component and substrate.
- 2.6 FABRICATION
- A. Form exposed surfaces from single sheet of stock, free of joints. Form surfaces flat without distortion, scratches or dents. Weld and grind smooth joints of fabricated components.
 - B. Back paint components where contact is made with building finishes to prevent electrolysis.
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July 11, 2018

- C. Shop assemble components and package complete with anchors and fittings. Hot dip galvanize exposed and painted ferrous metal and fastening devices. Provide steel anchor plates, adapters, and anchor components for installation.

2.7 FACTORY FINISHING

- A. Ferrous metals: Clean and treat, spray apply one coat of baked-on rust and moisture-resistant primer, followed by two coats of baked-on synthetic enamel, in selected colors. Ensure that finish coating is uniform in color intensity and degree of gloss, throughout.
- B. Chrome/Nickel Plating: ASTM 456, Type SC2, satin finish.
- C. Stainless steel: Number 4 satin finish, except as otherwise specified above under the Article entitled "Toilet Accessories".

PART 3 - EXECUTION

3.1 PREPARATION

- A. Provide templates and rough-in measurements as required. Deliver inserts and rough-in frames to site at appropriate times for building-in by other trades
- B. Coordinate with trades responsible for providing receiving surfaces on which accessories will be installed.
- C. Exact locations of accessories within each room or area shall be as directed by the Architect.

3.2 INSTALLATION

- A. Perform installation work in accordance with the approved shop drawings and the manufacturer's installation instructions.
- B. Install toilet accessories absolutely level and in true line, securely and rigidly anchored with theft proof fasteners of the size and type most appropriate for the specific receiving surface, concealing the fasteners as far as practicable.

3.3 ADJUSTING

- A. Replace units which cannot be adjusted to operate freely and smoothly as intended for the application made.

3.4 CLEANING

- A. Remove all protective films and coverings from accessories, and clean and polish each piece. Remove all rubbish, packing materials, and debris, caused by the work of this Section.

End of Section

Section 10 40 00
SAFETY SPECIALTIES

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. The BIDDING REQUIREMENTS, CONTRACT FORMS, and CONTRACT CONDITIONS as listed in the Table of Contents, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Fire extinguishers.
 - 2. Fire extinguisher cabinets.
 - 3. Brackets for wall mounting.

1.3 RELATED REQUIREMENTS

- A. Section 06 10 00 - ROUGH CARPENTRY: Wood blocking.
- B. Section 09 22 16 - NON-STRUCTURAL METAL FRAMING: Framed wall openings
- C. Section 09 29 00 - GYPSUM BOARD: Gypsum wallboard finishes.

1.4 REFERENCES

- A. Referenced Standards: Comply with applicable requirements of the following standards and those others referenced in this Section. The standards referenced herein are included to establish recognized minimum quality only. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern. Equivalent quality and testing standards will be acceptable, subject to their timely submission, review and acceptance by the Engineer.
 - 1. NFPA 10 – Standard for Portable Fire Extinguishers, 2010 Edition.

1.5 SUBMITTALS

- A. Submit the following under provisions of Section 01 33 23 - SUBMITTALS:
 - 1. Literature: Manufacturer's product data sheets, indicating: fabrication specifications, finishes, dimensions of cabinet and rough opening, and installation instructions.
 - 2. Shop drawings: Details showing unit dimensions, methods of construction, attachment clips and brackets; and complete installation details.
 - 3. Selection samples: Samples indicating metal finishes available for selection by Engineer.

July 11, 2018

- a. Provide additional samples as requested by Engineer to facilitate initial selection of colors and finishes
4. Verification samples: Fire extinguisher cabinet in specified size, finishes, and door type, if requested by Engineer.

1.6 REGULATORY REQUIREMENTS

- A. Obtain certificate of compliance from authority having jurisdiction indicating approval of fire extinguisher cabinets and their installed locations.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Do not deliver cabinets or extinguishers to the site, until all specified submittals have been submitted to, and approved by, the Engineer.
- B. Store cabinets and extinguishers inside, under cover, and in manner to keep them dry, protected from weather, direct sunlight, surface contamination, corrosion and damage from construction traffic and other causes.

1.8 WARRANTY

- A. Deliver to the Owner upon completion of the work of this Section, applicable manufacturer's standard warranties.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
 1. J.L. Industries, Bloomington MN.
 2. Larsen Manufacturing Co., Minneapolis MN.
 3. Potter-Roemer, Union NJ.
 4. Amerex Corporation, Trussville, AL (*fire extinguishers only*)

2.2 PERFORMANCE REQUIREMENTS

- A. Conform to NFPA 10.

2.3 FIRE EXTINGUISHERS CABINETS AND BRACKETS:

- A. Fire extinguisher cabinets:
 1. Cabinet trim style: Square trim, semi-recessed cabinet.
 - a. Protruding from wall: 1-1/4 inches.
 2. Door and trim: Aluminum with clear anodized finish.
 - a. Full glazed design with breakable glazing.
 - b. Vigilante alarm: Provide 9 volt, battery operated (battery included), plunger activated. vigilante alarm.
 - c. Handles: Red door handles having raised letters "FIRE".

- d. Lettering: Factory applied die-cut lettering, applied to metal portion of door.
 - 1) Pattern: Horizontal reading.
 - 2) Color: Red
 - 3. Cabinet construction: 18 gage cold-rolled steel with factory applied white baked acrylic enamel finish.
 - 4. Acceptable models:
 - a. JL Industries "Academy Series", model number 2026. (aluminum)
 - b. Larsen "Architectural Series", model number AL-2712-RK
 - c. Potter-Roemer, "Alta Series", model number 7045 (alum)
 - B. Wall mounting Bracket: 16 gage steel surface mounted bracket, with red glossy polyester thermo-set coating, equal to the following. Provide with red letter decals spelling "FIRE EXTINGUISHER" applied to wall surface, letter size, style as required by code, location as selected by Engineer.
 - 1. JL Industries, model number "MB-810".
 - 2. Larsen model number 864.
 - 3. Potter-Roemer, model number 3903.
- 2.4 FIRE EXTINGUISHERS:
- A. Extinguishers: Multi-purpose dry chemical type (mono ammonium phosphate), 10 pound capacity, multi-purpose rated '4A, 60B:C'; with metal valves and siphon tubes, replaceable molded valve stem seals, pressure gauges and hose discharge.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Inspect all surfaces and verify that they are in proper condition to receive the work of this Section.
- B. Verify that prepared openings are ready to receive extinguisher cabinets.
- C. Beginning of installation means acceptance of project conditions.

3.2 INSTALLATION

- A. Install fire extinguisher cabinets in accordance with manufacturer's instructions in locations indicated, and as additionally directed by regulatory authority having jurisdiction.
- B. Do not commence installation of fire extinguisher cabinets until immediately adjacent surfaces have been completely installed and finished.
- C. Install cabinets absolutely level and in true line, with units securely anchored to the surrounding construction. Fit trim pieces accurately and tight to adjacent construction.
 - 1. Maximum variation from plumb and level: 1/8 inch.

2. Maximum offset from true dimensional alignment: 1/4 inch.

3.3 CLEANING AND ADJUSTMENT

- A. Upon completion of the work of this Section in any given area, remove tools, and all packaging and debris from the work area; leave area in broom-clean condition.
- B. After adjacent work is complete:
 1. Test each door and latching device, and make adjustments required to ensure a bind-free operation and proper latching.
 2. Remove all tape and other packing materials from fire extinguisher cabinets.
 3. Thoroughly clean and polish all exterior and interior surfaces of extinguisher cabinets, take care to remove dirt from corners. Clean metal and glass surfaces with mild cleaning agents as recommended by manufacturer.
 4. Touch-up all scratches and other surface defects, using same materials and colors as shop finish.

End of Section

Section 11 31 00
RESIDENTIAL APPLIANCES

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. The BIDDING REQUIREMENTS, CONTRACT FORMS, and CONTRACT CONDITIONS as listed in the Table of Contents, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. Install Owner Furnished (OFCI) residential appliances including, but not limited to, the following:
 - 1. Range with stainless steel wall panel.
 - 2. Dishwashers.
 - 3. Refrigerator.
 - 4. Freezers.
 - 5. Commercial three-bay sink.

1.3 RELATED REQUIREMENTS

- A. Section 06 40 00 - ARCHITECTURAL WOODWORK: Kitchen cabinets.
- B. Division 23 - HEATING, VENTILATING AND AIR CONDITIONING:
 - 1. Exhaust range hoods, (including connections).
- C. Division 26 - ELECTRICAL: Electrical supply to appliances.

1.4 REGULATORY REQUIREMENTS

- A. Ensure that Owner furnished products requiring electrical connections are Listed and classified by UL, as suitable for the purpose specified and indicated.
- B. Install the work of this Section in conformance with all applicable federal, state and municipal codes, laws and regulations regarding utilities, health, fire protection and safety.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Store all products in original packaging in protected interior location.
- B. Coordinate schedule of construction, size of access and route to place of installation to prevent delay of installation due to physical impediments. Any work involving the demolition and reconstruction of partitions, walls, floors, roofing, windows or doors to place and install the work of this Section shall be performed at not additional cost to the Owner.

PART 2 – PRODUCTS (not applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Inspect all surfaces and verify that they are in proper condition to receive the work of this Section. Notify the Contractor, and copy to Architect, in writing of any conditions detrimental to the proper and timely completion of the work, and do not proceed with the work until said conditions are corrected.
- B. Verify clearances required for equipment.
- C. Verify ventilation outlets, service connections, and supports are correct and in required location.
- D. Verify that electric power is available and of the correct characteristics.
- E. Beginning of installation means acceptance of existing site conditions.

3.2 INSTALLATION

- A. Install each product in accordance with manufacturers' instructions.
 - 1. Maximum variation for installed equipment, from true position of 1/16 inch in 8 feet for plumb and level and a maximum of 1/32 inch offsets in adjoining surfaces intended to be flush.
- B. Sequence installation and erection to ensure correct mechanical and electrical utility connections are achieved.
- C. Anchor equipment using devices appropriate for equipment, substrate and expected usage.

3.3 ADJUSTING

- A. Adjust work under provisions of Section 01 73 00 - EXECUTION.
- B. Adjust equipment to ensure proper working order and conditions.
- C. Remove and replace equipment creating excessive noise, or vibration.
- D. After installation is completed, insure that operating parts work freely and fit neatly. Adjust hardware and catches as required. Repair or replace damaged parts dents, buckles, abrasions, scraps or other damage affecting the appearance or serviceability.

3.4 CLEANING

- A. At completion of each work day, remove tools and all crating boxes, coverings, rubbish and debris from the work area; leave area in broom-clean condition.
- B. Upon completion of the work of this Section, remove tools and all crating boxes, coverings, rubbish and debris from the work area; leave area in broom-clean condition.

July 11, 2018

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ADDITION/RENOVATION
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- C. Clean Work under provisions of Section 01 73 00 - EXECUTION::
 - 1. Wash and clean appliances.
 - 2. Clean and polish glass, plastic, hardware and accessories, fixtures and fittings.

- D. Remove protective coverings from prefinished work just prior to Owner's acceptance of facility.

End of Section

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Section 14 22 00
COMPACT TRACTION ELEVATORS
(FILED SUB-BID REQUIRED)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. The BIDDING REQUIREMENTS, CONTRACT FORMS, and CONTRACT CONDITIONS as listed in the Table of Contents, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Work of this Section requires Filed Sub-Bids and is governed by the provisions of the Massachusetts General Laws (MGL), Public Bidding Law - Chapter 149, Sections 44A to 44J inclusive, as amended, and applicable Sections of the MGL, Public Contract Law - Chapter 30.
- C. The work to be completed by the Filed Subcontractor for the work of this Section is shown on the following listed Drawings:
 - G-001 TITLE SHEET
 - G-002 CODE SUMMARY, NOTES & DRAWING LIST
 - AD-101 EXISTING & SELECTIVE REMOVAL PLANS
 - A-100 BASEMENT PLAN
 - A-101 FIRST FLOOR PLAN
 - A-102 SECOND FLOOR PLAN
 - A-103 ROOF PLAN
 - A-201 EXTERIOR ELEVATIONS
 - A-301 BUILDING SECTIONS
 - A-402 ELEVATOR
 - S-1.0 STRUCTURAL FRAMING PLANS
 - S-2.0 TYPICAL STRUCTURAL DETAILS GENERAL NOTES
 - H-202 HVAC SECOND FLOOR NEW WORK PLAN
 - E-003 ELECTRICAL SCHEDULES AND DETAILS
 - 1. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section. The listing of Contract Drawings above does not limit Filed Subcontractor's responsibility to determine full extent of work of this Section as required by all Drawings listed in the Drawing List on the Drawing Title Sheet, as modified by Addenda.
- D. Filed Sub-Bids for work under this Section shall be for the complete work and shall be submitted electronically to the Awarding Authority at time, and in manner stipulated in the INVITATION TO BID and INSTRUCTIONS TO BIDDERS.
 - 1. Each Sub-Bid submittal for work under this Section shall be accompanied with the required bid deposit.
- E. Sub Sub-Bid Requirements: NONE REQUIRED UNDER THIS SECTION.

1.2 SUMMARY

- A. Furnish and install: One "machine-room-less type" (MRL) electric traction elevator. Elevator work includes:

1. Commercial, standard pre-engineered passenger elevator.
 2. Elevator car enclosure, hoistway entrances and signal equipment.
 3. Operation and control systems.
 4. Accessibility provisions for physically disabled persons.
 5. Equipment, machines, controls, systems and devices as required for safely operating the specified elevators at their rated speed and capacity.
 6. All other devices, materials and accessories for operation, dispatching, safety, security, leveling, and alarms, as required to complete the elevator installation.
- B. Furnish the following products to be installed under the designated Sections:
1. Inserts, required to be cast into concrete: installed by Section 03 30 00 - CAST-IN-PLACE CONCRETE.
- C. Provide 5 year maintenance and call-back services contract for elevator equipment furnished corresponding with elevator warranty.

1.3 RELATED REQUIREMENTS

- A. Section 03 30 00 - CAST-IN-PLACE CONCRETE.
1. Concrete elevator pit foundation.
 2. Embedded concrete anchorage.
- B. Section 04 22 00 – CONCRETE UNIT MASONRY: Hoistway wall construction.
- C. Section 05 50 00 - METAL FABRICATIONS:
1. Grouting thresholds.
 2. Elevator pit ladder.
 3. Overhead hoist beam.
 4. Supports for guide rail brackets, and continuous supports for sills at each hoistway entrance.
- D. Section 08 90 00 - LOUVERS AND VENTS: Shaft exhaust louver.
- E. Section 10 40 00 - SAFETY SPECIALTIES: Fire extinguisher in elevator machine room.
- F. Division 23 - HVAC: Ventilation system and temperature control of elevator machine room.
- G. Division 26 - ELECTRICAL:
1. Temporary power supply.
 2. Fused mainline switches or circuit breakers in the machine room, including feeders from the mainline switch to controllers or starters.
 3. Electrical service to elevators, including fused disconnect switches.
 4. Heat and smoke sensing devices.
 5. Convenience outlets and illumination in machine room, hoistway and pit.
 6. Emergency generator for elevator operation.

7. Fire and smoke detectors and interconnecting devices; fire alarm signal lines to contacts in the machine room.

1.4 EXAMINATION OF SITE AND DOCUMENTS

- A. 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 (Owner) will not be responsible for errors, omissions and/or charges for extra work arising from General Contractor's or Filed Subcontractor's failure to familiarize themselves with the Contract Documents or existing 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: Bidders are strongly encouraged to attend the Pre-Bid conference; refer to ADVERTISEMENT FOR BIDS for time and date.

1.1 REFERENCES

- A. Referenced Standards: Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
 1. ANSI A117.1 - Providing Accessibility and Usability for Physically Handicapped People.
 2. ANSI/ASME A17.1 - American Standard Safety Code for Elevators, Dumbwaiters, Escalators, and Moving Walks
 3. ANSI/ASME A17.2 - Inspection of Elevators, Escalators, and Moving Walks.
 4. NFPA 80 - National Electrical Code.
 5. UL: Applicable requirements for motors, switches and other electrical components.
 6. All applicable federal, state and municipal codes, laws and regulations for elevators, including barrier-free requirements.

1.2 DEFINITIONS

- A. All terms in this Section shall have meaning defined in the Safety Code for Elevators, Dumbwaiters, Escalators and Moving Walks, ANSI A17.1, including all revisions and modifications thereto. In all cases where a device or part of the equipment is herein referred to in the singular number, it is intended that such reference shall apply to as many such devices as are required to complete the installation.

1.3 SEQUENCING

- A. Coordinate work of this Filed Subcontract with that of other trades, affecting or affected by this work, and cooperate with the other trades as is necessary to assure the steady progress of work.

July 11, 2018

- B. Do not order or deliver any materials until all submittals, required in the listed Specification Sections included as part of this Filed Subcontract, have been received and approved by the Architect.
- C. Before proceeding with installation work, inspect all project conditions and all work of other trades to assure that all such conditions and work are suitable to satisfactorily receive the work of this Section and notify the Architect in writing of any which are not. Do not proceed further until corrective work has been completed or waived.

1.4 SUBMITTALS

- A. Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
 - 1. Literature: Manufacturer's product data sheets, specifications, performance data, for elevator components furnished, including:
 - a. Signal and operating fixtures, operating panels, indicators.
 - b. Cab design, dimensions, layout and components.
 - c. Cab and hoistway door and frame details.
 - d. Electrical characteristics and connection requirements.
 - 2. Manufacturer's warranties: Manufacturer's written warranty, countersigned by the installer, clearly stating all terms and conditions of the warranty, and covering all materials and workmanship provided for a period of not less than one year from date of Substantial Completion of the General Contract.
 - 3. Shop drawings: Large scale drawings indicating general arrangement for all elevator equipment; indicate on drawings:
 - a. Motor, controller selector, governor and other component locations.
 - b. Car, machine beams, guide rails, buffers, and other components in hoistway.
 - c. Rail bracket spacing; maximum loads imposed on guide rails requiring load transfer to building structural framing.
 - d. Individual weight of principal components; load reaction at points of support.
 - e. Loads on hoisting beams.
 - f. Landing heights, entrance dimensions, and tolerances of shaft dimensions.
 - g. All electrical characteristics and requirements for the elevator equipment, including heat release and regenerative amps and KW.
 - h. Cab dimensions, show a horizontal emergency stretcher inside of cab with equivalent ease, verifying compliance with MA 524 CMR 17.40 requirements.
 - 4. Manufacturer's certification: Manufacturer's letter, certified by a Notary Public, stating that no proprietary equipment, as is specified under Part 2 - Products, will be used in the installation.
 - 5. Samples: Sample chips of all finishes in elevator car, hoistway doors and frames, and all available colors for, plastic laminate, paints, and finishes, for selections by the Architect.
- B. Submit the following under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS:

1. Parts list and wiring diagrams: Upon completion of the installation, submit four (4) copies of a complete parts list and as-built wiring diagrams for controller and elevator system and maintenance instruction manual.
2. Provide technical information for servicing operating equipment.
3. Include legible schematic of hydraulic piping and wiring diagrams of installed electrical equipment, and changes made in the work. List symbols corresponding to identity or markings on machine room and hoistway apparatus.
4. Provide one copy of master electric and hydraulic schematic and one copy of lubrication chart, each framed with clear glass; mounted on machine room wall in location designated by Architect.
5. Manufacturer's written installation warranty and maintenance contract as specified herein below.

1.5 QUALITY ASSURANCE

- A. In the interest of unified responsibility, the elevator installer shall be either the actual equipment manufacturer or a firm fully authorized by the manufacturer of the proposed equipment to install the equipment; regularly engaged in the business of manufacturing, installing, and servicing elevators of the type and character required under this Section, with all major components, including the entire power unit, controller, hydraulic cylinder, door operators, signal fixtures, and other major items, being the products of a single elevator manufacturer.

1.6 REGULATORY REQUIREMENTS

- A. All designs, clearances, construction, workmanship, and material, unless specifically excepted, shall be in accordance with the requirements of:
 1. ASME/ANSI A17.1 Safety Code for Elevators and Escalators.
 2. Commonwealth of Massachusetts Regulation 521 CMR: ARCHITECTURAL ACCESS BOARD, as amended.
 3. Commonwealth of Massachusetts Regulation 524 CMR - State Elevator Code as amended.
 4. NFPA 70 National Electrical Code.
 5. NFPA 80 Fire Doors and Windows.
- B. Work shall be in full conformance with all regulations for the physically handicapped in accordance with ANSI Publication No. A-117.1 Part 4, Series 4.12, Design of Barrier-Free Facilities, the recommendations of United States Department of Justice, N° 28 CFR Part 36 - AMERICAN WITH DISABILITIES ACT Public Law 101-336, (referred to herein as "ADA"), local authorities, and all other governing bodies which may have jurisdiction.
- C. Work shall conform to seismic requirements of ANSI A17.1 for Seismic Zone 2.
- D. Products requiring electrical connection: Listed and classified by Underwriter's Laboratories, Inc., as suitable for the purpose specified and indicated.

1.7 PERMITS, TESTS AND INSPECTIONS

- A. Obtain and pay for all necessary municipal and State elevator inspections and permits; make all tests as required by the regulations of such authorities. The

July 11, 2018

capacity and operational performance tests shall be conducted in the presence of the Architect and the code enforcement officer, after completion of the installation.

- B. Obtain certificate of compliance from authority having jurisdiction indicating approval of installed elevator.

1.8 SEQUENCING AND SCHEDULING

- A. Coordination:
 - 1. General: Coordinate the work of this Section with the respective trades responsible for installing interfacing and adjoining work for proper sequence of installation, and ensure that the work performed hereunder is acceptable to such trades for the installation of their work.
 - 2. Coordinate elevator controls to building security system with Owner's security vendor.
- B. Provide all items which will require building into the concrete in sufficient time as not to delay the progress of the respective trades. Should such items not be delivered in time to be built in, pay all costs for the required cutting and installation work.

1.9 WARRANTY

- A. General: Submit warranties under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS, and in compliance with Section 01 78 36 – WARRANTIES.
- B. Provide 5 year warranty which shall include all materials and workmanship for the elevator system and its installation. countersigned by the elevator installer, clearly stating all terms and conditions of the guarantee, and covering all materials and workmanship provided for a period of not less than five (5) years from date of Substantial Completion of the General Contract.

1.10 MAINTENANCE

- A. Provide Installers maintenance contract under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS, for a period equal to warranty. Maintenance contract shall include the following:
 - 1. 24-hour emergency callback service for the equipment.
 - 2. Monthly examinations of the installation during regular working hours by trained employees of the elevator manufacturer.
 - 3. All necessary adjusting, greasing, and oiling.
 - 4. Cleaning supplies and parts necessary to keep the equipment in proper operation, except any parts needed due to misuse, accident, or neglect caused by others.
- B. Repair work shall be carried out only by the elevator installer's personnel, using only standard parts furnished by the elevator manufacturer. Maintenance shall be carried out directly by the elevator installer and shall not be assigned or transferred to any agent.

July 11, 2018

1.11 TEMPORARY USE OF ELEVATOR

- A. Prohibited Use: Elevators shall not be used for any purpose during the construction period before Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURE AND TYPE

- A. Basis of Design: To establish a standard of quality, design and function desired, Drawings and specifications have been based on Kone, Inc., Product: "MonoSpace 500 Low-Rise Elevator".
1. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following:
- a. Kone Inc., Moline, IL.
 - b. Otis Elevator Company, Farmington CT.
 - c. ThyssenKrupp Elevator Company, Memphis TN.
 - d. Schindler Elevator Corporation, Gettysburg PA.
- B. Barrier free design: Provide for handicapped requirements in accordance with ANSI Publication No. A-117.1 Part 4, Series 4.12, Design of Barrier-Free Facilities, Americans with Disabilities Act (ADA) and all applicable Federal, State and Local codes.
- C. General characteristics for Passenger Elevators:

Load (rated capacity):	3000 pounds, IBC stretcher compliant
Car speed:	150 feet per minute (0.76 M/sec)
Operation:	Simplex collective, selective
Total Rise:	17'-5"
Stops:	Front entrances: B, 1, 2
Height under car top:	8'-0"
Height under ceiling:	7'-4.5"
Clear car inside:	6'-11" wide by 4'-4" deep
Car door type:	Left opening..
Hoistway entrance:	3'-6" wide by 7'-0" high.
Operation:	Selective collective, microprocessor control
Power supply:	208 volts, 3 phase, 60 hertz (plus or minus 5 percent of normal with separate equipment conductor).
Lighting Supply:	120 volts, 1 phase, 60 hertz
Signal supply:	120 volts, 1 phase, 60 hertz

- D. Load capacity: Safely lower, stop, and hold up to 125 percent rated load.
- E. Speed: Plus or minus 2 percent contract speed under any loading condition or direction of travel.

- F. Stopping Accuracy: $\pm 1/4$ inch (6.4 mm) under any loading condition or direction of travel.
- G. System Performance:
 - 1. Vertical Vibration (maximum): 25 mg.
 - 2. Horizontal Vibration (maximum): 25 mg.
 - 3. Jerk Rate (maximum): 1.3 ft/sec³.
 - 4. Acceleration (maximum) 1.3 ft/sec².
 - 5. In Car Noise: = 55 dB(A).
 - 6. Leveling Accuracy: 0.2 inches.
 - 7. Starts per hour (maximum): 120.
 - 8. Walls: reinforced 16 gauge cold-rolled steel with two coats factory applied baked enamel finish, with applied wood core panels covered with wood veneer.
 - a. Species and cut:
 - 9. Canopy: Reinforced 14 gauge cold-rolled steel with hinged exit. Finish: Two coats factory applied reflective baked enamel.

2.2 GEARED HOISTING MACHINE

- A. Design the geared traction machine to meet the sever service encountered in elevator operation. A properly grooved sheave shall be driven through a worm and gear by a moderate speed motor. The sheave wheel shall be mounted with heavy tapered roller bearings on a rigid shaft.
- B. The gear housing, brake, and motor shall be mounted on a rigid bed plate. The gear housing shall be divided horizontally at the center fine of the shaft to provide access to the worm gear. A gasket inspection handhole shall be provided in the lower half o the housing to permit inspection of the gear. Suitable drain plugs, shall be provided.
- C. The sheave and gear spider shall be cast integral. The bronze worm gear shall be press At and securely bolted to the spider. The sheave material shall be of semi-steel of the proper hardness to give minimum wear of sheave and cables.
- D. The worm gear shall be machined Form a heavy ring of special gear bronze and shall have accurately hobbled teeth. Shoulder bolts which secure the gear to the spider shall be fitted into reamed holes to secure a snug fit.
- E. Accurately machine the worm and its shaft in one piece, of special alloy steel. Mount the worm shaft on at least two sleeve guide bearings, one of which shall contain oversize double acting preloaded ball thrust-bearings. Provide an oil seal at the motor end or the worm shaft. The thrust-bearing shall be removable without dismantling the machine
- F. Brake:
 - 1. Type: Spring actuated, For direct current, electrically released; heavy construction; proper braking area For the load and speed specked.
 - 2. Two shoes actuated by two separate compression springs.

3. Capacity: Sufficient power to stop and hold the car with full contract load.

G. Hoisting Motor:

1. Type: Direct current, reversible machine motor.
2. Design: High starting torque with low starting current; designed to stand the severe loads encountered in elevator service; sufficient capacity to operate with the contract load and speed without over-heating.
3. Rating: In accordance with the standard of the IEEE For 50°C., 60 minute motors.

2.3 DEFLECTOR

- A. Sheaves shall be made of suitable cast iron, free of pits, warps or other imperfections, accurately and precisely machined and grooved For the hoisting cables.
- B. Shafts shall be made of prime quality steel, machined accurately to fit the sheaves and bearings and to adequately support the varying loads imposed upon the sheaves,
- C. Bearings shall be of the roller type of best quality, arranged For adequate lubrication and inspection.

2.4 HOISTWAY EQUIPMENT

- A. Platform: Fabricated frame of formed or structural steel shapes, gusseted and rigidly welded with a wood subfloor. Underside of the platform shall be fireproofed.
- B. Sling: Steel stiles affixed to a steel crosshead and bolstered with bracing members to remove strain from the car enclosure.
- C. Guide Rails: Steel, omega shaped, fastened to the building with steel brackets.
- D. Guide Shoes: Roller guides, with a minimum of three tires, shall be mounted on top and bottom of the car and counterweight frame and be held in contact with the guide rail by adjustable devices.
- E. Guide Rail Lubricators: Provide a leakproof reservoir on top of upper guide shoes. Wool felt wiper shall apply an even, uniform flow of lubricant which shall thoroughly cover face of guide rail.
- F. Buffers: Provide substantial buffers in the elevator pit. Mount buffers on continuous channels fastened to the elevator guide rail or securely anchored to the pit floor. Provide extensions if required by project conditions.
- G. Automatic Terminal Limits: Place electric limit switches in the hoistway near the terminal landings. Limit switches shall be designed to cut off the electric current and stop the car if it runs beyond either terminal landing.
- H. Automatic Self-Leveling: Provide each elevator car with a self-leveling feature to automatically bring the car to the floor landings and correct for overtravel or undertravel. Self-leveling shall, within its zone, be automatic and independent of the operating device. The car shall be maintained approximately level with the landing irrespective of its load.

July 11, 2018

- I. Failure Protection: Design electrical control circuit so if a malfunction occurs, due to motor starter failure, oil becoming low in the system, or the car failing to reach a landing in the up direction within a pre-determined time, the elevator car will automatically descend to the lowest terminal landing. If power operated doors are used, the doors will automatically open when the car reaches that landing to allow passengers to depart. The doors will then automatically close and all control buttons, except the "door open" button in the car station, shall be made inoperative.
- J. Wiring: Provide all necessary hoistway wiring in accordance with the National Electrical Code.
- K. Emergency Terminal Stopping Device: Provide emergency terminal stopping devices for speeds over 100 FPM. The emergency terminal stopping device shall operate independently of the normal terminal stopping device if it fails to slow down the car at the terminal as intended. Stopping devices shall not be prevented from functioning by a single short circuit caused by a combination of grounds or by other conditions.
 - 1. Normal and emergency terminal stopping devices shall not control the same controller switches unless two or more separate and independent switches are furnished, two of which shall be closed in either direction of travel to complete the circuit to the control valve solenoids in the down direction and to complete the circuit to the pump motor for the up direction of travel.

2.5 POWER UNIT

- A. Motor: Standard manufacture motor specifically designed for oil-hydraulic elevator service. Duty rating shall comply with specified speeds and loads.
- B. Power controller shall contain electrical contactors, electro-mechanical switches and thermal overload relays. Mount components in a NEMA 1 enclosure. Logic control system shall be microprocessor based and protected from environmental extremes and excessive vibrations.
- C. Reduced Voltage Starting: Provide a solid state starter to limit current inrush during starting and to provide gradual acceleration of the motor. Motor starting shall not be initiated by mechanical contacts. Starter shall include a current limit adjustment range of 200 percent to 450 percent of the overload adjustment range. Provide an integral fault detection and diagnostic system.

2.6 ELECTRICAL COMPONENTS

- A. Boxes, conduit, wiring, and devices: As required by ANSI/NFPA 70.
- B. Fittings: Steel compression type for electrical metallic tubing. Fittings with set screws are acceptable only when a separate grounding conductor is also installed across the joint.
- C. Spare conductors: Provide 10 percent extra conductors and two pairs of shielded audio cables in traveling cables. Do not parallel conductors to increase electric current capacity unless individually fused.
- D. Do not use armored flexible metal conduit as a grounding conductor.

July 11, 2018

- E. Include wiring and connections to elevator devices remote from hoistway and between elevator machine rooms. Provide additional components and wiring to suite machine room layout.
 - 1. Do not use armored flexible metal conduit as a grounding conductor.

2.7 HOISTWAY ENTRANCES

- A. Doors and Frames: Provide complete hollow metal type hoistway entrances at each hoistway opening.
 - 1. Manufacturer's standard entrance design, bearing Underwriters' Laboratories "B" labels, and consisting of 14 gauge frames with 2 inch (50 mm) profile, 16 gauge doors, hangers, hanger supports, hanger covers, fascia plates, sight guards, and necessary hardware.
 - 2. Elevator wall interface with hoistway entrance assembly shall comply with elevator manufacturer's requirements.
 - 3. Doors: Flush construction.
 - a. First Floor and Basement Level: Stainless steel, ASTM A 167, Type 304 stainless steel panels, No. 4 satin finish.
 - b. Second Floor through Roof Level: Steel: ASTM A 366 steel panels, factory-applied baked enamel finish.
 - 4. Frames: Formed construction.
 - a. First Floor and Basement Level: Stainless steel, ASTM A 167, Type 304 stainless steel panels, No. 4 satin finish.
 - b. Second Floor through Roof Level: Steel: ASTM A 366 steel panels, factory-applied baked enamel finish.
- B. Interlocks: Equip each hoistway entrance with an Underwriters' Laboratories "B" label approved type interlock tested as required by code. Interlock shall be designed to prevent operation of the car away from the landing until the doors are locked in the closed position as defined by code and shall prevent opening the doors at any landing from the corridor side unless the car is at rest at that landing or is in the leveling zone and stopping at that landing.
- C. Door Hanger and Tracks: Provide sheave type two point suspension hangers and tracks for each hoistway sliding door.
 - 1. Sheaves: Polyurethane tires with ball bearings properly sealed to retain grease.
 - 2. Hangers: Provide an adjustable slide to accommodate the up-thrust of the doors.
 - 3. Tracks: Drawn steel shapes, smooth surface and shaped to conform to the hanger sheaves.
- D. Hoistway Sills: Extruded, with grooved surface, 1/4 inch (6.4 mm) thickness.
 - 1. Aluminum: ASTM B 221 aluminum, mill finish.
 - 2. Where floors are scheduled for carpet, raise sills 1/2 inch.
- E. Doors and sight guards: Sight guards shall be furnished on the leading edge of the doors to conceal the hoistway beyond the doors, and finished to match door panels. Fabricate doors from 16 gauge sheet steel (minimum).

July 11, 2018

2.8 DOOR OPERATION:

- A. Door operator: Doors on the car and at the hoistway entrances shall be power-operated by means of an operator mounted on top of the car. The door operators shall have mechanically operated limits and the motor shall have positive control over door movement for smooth operation. Each car door shall be provided with a protective device.
 - 1. Door operators shall not be proprietary to elevator manufacturer. Operators shall be as manufactured by G.A.L., Moline, or other approved equal.
- B. Door opening time:
- C. Door Protection Devices: Provide a door protection system using 40 microprocessor controlled infra-red light beams. The beams shall project across the car opening detecting the presence of a passenger or object. If door movement is obstructed, the doors shall immediately reopen. A mechanical reopening device is not acceptable.

2.9 CAR ENCLOSURES

- A. Car Enclosure:
 - 1. Walls: reinforced 16 gauge cold-rolled steel with two coats factory applied baked enamel finish, with applied vertical 5/8 inch thick composition board core, laminated front and back with plastic laminate. Edges of each panel shall be plastic laminate, or painted black..
 - 2. Canopy: Reinforced 14 gauge cold-rolled steel with hinged exit. Finish: Two coats factory applied reflective baked enamel.
 - 3. Ceiling: Downlight type, 16 gauge metal pans with LED downlights suspended and dimmer switch 7'-4" (2235 mm) above the finished floor. Number of downlights shall be dependent on platform size with a minimum of six.
 - a. Metal panels: Stainless steel, No. 4 satin finish.
 - 4. Cab Columns, Front, and Transom: Stainless steel, No.4 satin finish.
 - 5. Doors: Horizontal sliding car doors reinforced with steel for panel rigidity. Hang doors on sheave type hangers with polyurethane tires that roll on a polished steel track and are guided at the bottom by non-metallic shoes sliding in a smooth threshold groove.
 - a. Door Finish: Stainless steel, No.4 satin finish
 - 6. Cab Sills: Extruded, with grooved surface, 1/4 inch (6.4 mm) thickness.
 - a. Aluminum: ASTM B 221 aluminum, mill finish.
 - 7. Handrail: Continuous type metal bar handrail with ends curved to the wall, nominal 1/4" x 4 inches, stainless steel satin finish. Provide at rear and side walls.
 - 8. Ventilation: Two speed exhaust fan mounted on the car top.
 - 9. Pad Buttons: Provide pad buttons on cab front(s) and walls.
 - a. Provide one set of vinyl protection pads for the project.
 - 10. Finished Floor: Provided under Division 9 Sections.

July 11, 2018

- B. Car Top Inspection: Provide a car top inspection station with an "emergency stop" switch and constant pressure "up-down" direction buttons to make the normal operating devices inoperative and give the inspector complete control of the elevator. Mount the car top inspection station in the door operator assembly.
- C. Provide rubber isolation pads to dampen vibration or noise from the oil hydraulic system being transmitted to the car frame and platform.

2.10 CAR OPERATING STATION

- A. Car Operating Station, General: The main car control in each car shall contain the devices required for specific operation mounted in a No. 4 stainless steel integral swing return panel requiring no applied faceplate.
 - 1. The lowest module shall contain the "door open," "door close," "alarm" buttons and a keyed "emergency stop" switch.
 - 2. Intermediate modules shall contain floor buttons which illuminate when a call is registered and remain illuminated until the call is answered. Raised floor indications and handicap symbols shall be located immediately adjacent to the floor buttons and be fully integrated in the module design. No applied symbols or floor indications or symbols on the buttons shall be permitted.
 - 3. The next module shall contain required switches.
 - 4. The top module shall contain fire service features in accordance with ASME A17.1, Rule 211.3, including operating instructions.
- B. Position Indicator: An electronic dot matrix position indicator. As the car travels, its position in the hoistway shall be indicated by the illumination of the alpha/numeric character corresponding to the landing which the elevator is stopped or passing.
- C. Emergency Light: An emergency light and capacity plate. Emergency light shall illuminate automatically upon loss of the building's normal power supply.
- D. Communications systems:
 - 1. General: Provide traveling cables with sufficient shielded wires plus two spares into the car.
 - 2. Telephone cabinet: A telephone cabinet shall be furnished in the return panel below the car buttons.
 - 3. Emergency Communications System: Provide an emergency communications device mounted in the swing return. Emergency communications device shall comply with Americans with Disabilities Act (ADA) requirements.
- E. Soffit Mounted Car Riding Lantern: A car riding lantern shall be installed in the elevator cab and located in the entrance. The lantern, when illuminated, will indicate the intended direction of travel. The lantern will illuminate and a signal will sound when the car arrives at a floor where it will stop. The lantern shall remain illuminated until the doors begin to close.
- F. Special Accessories:
 - 1. Independent service switch.
 - 2. Inspection switch.
 - 3. Two speed fan/light switch.

4. Telephone jack.
5. Certificate frame.

2.11 CONTROL SYSTEMS

- A. Controller: The elevator control system shall be microprocessor based and software oriented and be linked together for purposes of communication by a serial communications link. Control of the elevator shall be automatic in operation by means of push buttons in the car numbered to correspond to floors served, for registering car stops, and by "up-down" push buttons at each intermediate landing and "call" push buttons at terminal landings.
1. Momentary pressing of one or more buttons shall dispatch the car to the designated landings in the order in which the landings are reached by the car, irrespective of the sequence in which the buttons are pressed. Each landing call shall be cancelled when answered.
 2. When the car is traveling in the up direction, it shall stop at all floors for which car buttons or "up" hall buttons have been pressed. The car shall not stop at floors where "down" buttons have been pressed, unless the stop for that floor has been registered by a car button or unless the down call is at the highest floor for which any buttons have been pressed. Pressing the "up" button when the car is traveling in the down direction shall not intercept the travel unless the stop for that floor has been registered by a car button or unless the up call is the lowest for which any button has been pressed.
 3. When the car has responded to its highest or lowest stop, and stops are registered for the opposite direction, its direction of travel shall reverse automatically and it shall then answer the calls registered for that direction. If both up and down calls are registered at an intermediate floor, only the call corresponding to the direction of car travel shall be canceled upon the stopping of the car at the landing.
- B. Microprocessor: Locate the main microprocessor and car controller behind the elevator swing return panel.
1. Microprocessor door operator shall reside in the door operator and control all functions of the elevator door(s).
 2. Microprocessor selector shall reside on the car top and contain hall effect transducers that detect magnetic fields. Locate the magnetic fields on a perforated metal tape that runs the length of the hoistway.

2.12 AUXILIARY OPERATION AND CONTROLS

- A. General: In addition to primary control system features, provide the following controls or operational features for elevator.
- B. Special emergency service - Phase I (SES-I), "Fire-fighter's Emergency Operation": The activation of a key switch in the Level 1 hall button shall return car to Level 1 by-passing all car and hall calls. The car shall park at Level 1 with their doors open and not respond to car or hall calls unless the SES-II key switch in the car is activated. The system shall be in conformance with the current ANSI Code, Section 211.3. The elevator installer shall furnish contacts on the elevator controller to receive alarm signals from smoke/heat detectors furnished by others. If an elevator is on Independent Service, when the elevator is recalled, a continuous buzzer will sound in the car and a warning light shall be illuminated.

July 11, 2018

- C. Special emergency service - Phase II (SES-II), "Fire-fighter's Emergency Operation": in-car control of elevator during the emergency operation, by means of a key switch in car shall be provided. Operation shall be per ANSI Code, Rule 211.3.
- D. Emergency Medical Service (EMS): Supply in accordance with the Chapter 30, International Building Code, and as amended by jurisdictional codes and regulations where project is located.
 - 1. Priority service shall be activated via keyed switch located at each elevator lobby.
 - 2. Activation of the keyed switch at any floor shall cause the selected EMS elevator to return nonstop to floor of activation.
 - 3. Activation of the keyed switch in the EMS car's panel will allow emergency medical personnel to retain control of the elevator until key is removed. Returning the keyed switch to 'off' position, shall cause the car to be automatically restored to normal service within 90 seconds.
 - 4. Fire-Fighters emergency services (SES) shall override EMS priority service.
- E. Emergency/secondary power operation:
 - 1. Emergency/Secondary power will be provided by the same feeder as normal operational power at elevator's controller.
 - 2. The system shall automatically run Elevator down to Level 1 at full speed where it shall park with doors open.
 - 3. The system shall include a manual override for the use of the Fire Dept. or emergency personnel. Work under this Section shall include manual interlocking switches, (for manual control, automatic operation and off).
 - 4. Furnish and install the necessary equipment and wiring from the respective elevator controllers to the switches in the First Floor call panel.
- F. Provide emergency lighting system for car.

2.13 HALL STATIONS

- A. Hall Stations, General: Buttons shall illuminate to indicate call has been registered at that floor for the indicated direction. Faceplates shall be stainless steel No. 4 satin finish. Provide one set of risers.
 - 1. Each terminal station shall contain one illuminating pushbutton.
 - 2. Each intermediate station shall consist of two illuminating pushbuttons, one for the up direction and one for the down position.
 - 3. Phase 1 firefighters service keyswitch, with instructions, shall be incorporated into the hall station at the designated level.
- B. Floor Identification Pads: Provide door jamb pads at each floor. Jamb pads shall comply with Americans with Disabilities Act (ADA) requirements.
- C. Hall Lanterns: Install a hall lantern with an audible signal at each landing entrance for each elevator. The lanterns, when illuminated, shall indicate the elevator car which shall stop at the landing and in what direction the car is set to travel. When the car reaches a predetermined distance from the floor where it is going to stop, the corresponding hall lantern shall illuminate and the signal shall sound. The hall

July 11, 2018

lantern shall remain illuminated until the car doors close in preparation for leaving the floor.

1. Faceplates shall be No. 4 satin stainless steel finish.

D. Hall Position Indicator: A dot matrix position indicator shall be provided and inclined 20 degrees from vertical and mounted in a module for optimum viewing. As the car travels, its' position in the hoistway shall be indicated by the illumination of the alpha/numeric character corresponding to the landing which the elevator is stopped or passing. When hall lanterns are provided, the position indicator shall be combined with the hall lanterns in the same faceplate.

1. Faceplates shall be No. 4 satin stainless steel finish.

2.14 FINISHES, GENERAL

A. Structural Metal Surfaces: Clean surfaces of rust, oil or grease; wipe clean with solvent and prime two coats.

B. Machine Room Components: Clean and degrease; prime one coat, finish with two coats of enamel.

C. Galvanized Surfaces: Clean with neutralizing solvent; prime with two coats.

D. Aluminum: Mill finish.

E. Wood Surfaces not Exposed to Public View: One coat primer and one coat enamel.

F. Baked Enamel on Steel: Clean and degrease metal surface; apply one coat of primer sprayed and baked; two finish coats of enamel sprayed and baked.

G. Stainless steel: Number 4 brushed finish.

2.15 SCAFFOLDS AND STAGING

A. General: Filed Subcontractors shall obtain required permits for, and provide scaffolds, staging, and other similar raised platforms, required to access their Work as specified in Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS and herein.

1. Scaffolding and staging required for use by this Filed Subcontractor pursuant to requirements of Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS shall be furnished, erected, maintained in a safe condition, and dismantled when no longer required, by this Filed Sub-Trade requiring such scaffolding.

2. Each Filed Subcontractor is responsible to provide, maintain and remove at dismantling, all tarpaulins and similar protective measures necessary to cover scaffolding for inclement weather conditions other than those required to be provided, maintained and removed by the General Contractor pursuant to MGL (Refer to Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS and as additionally required for dust control).

3. Furnishing portable ladders and mobile platforms of all required heights, which may be necessary to perform the work of this trade, are the responsibility this Filed Subcontractor.

2.16 HOISTING MACHINERY AND EQUIPMENT

- A. All hoisting equipment, rigging equipment, crane services and lift machinery required for the work by this Filed Subcontractor shall be furnished, installed, operated and maintained in safe conditions by this Filed Subcontractor, as referenced under Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Inspect all surfaces, and required embedded anchorage devices, and verify that they are in proper condition to receive the work of this Section. Verify that field measurements are as indicated on approved shop drawings.

3.2 PREPARATION

- A. Arrange for temporary electrical power for installation work and testing of elevator components.

3.3 INSTALLATION

- A. Perform the installation in accordance with the approved shop drawings and the manufacturer's written instructions, ANSI/ASME A17.1 and those standards required by authority having jurisdiction, and with the additional requirements specified herein.
- B. Install system components. Connect equipment to building utilities. Install piping between hoistway plunger and pump unit.
- C. Furnish and install all internal and operational wiring, conforming to the requirements of the National Electrical Code, as necessary to connect the operating buttons and switches, from the control board to the power unit. Except for short lengths of flexible conduit to moving apparatus, ensure that all wiring is contained in rigid conduit or electrical metal tubing.
- D. Mount motor and pump unit on vibration and acoustic isolators, on bed plate and concrete pad. Place unit on structural supports and bearing plates. Securely fasten to building supports. Prevent lateral displacement.
- E. Accurately machine and align guide rails. Form smooth joints with machine splice plates. Install guide rails using threaded bolts with metal shims and lock washers under nuts. Compensate for expansion and contraction movement of guide rails.
- F. Bolt or weld brackets directly to structural steel hoistway framing. Chip and clean field welds of oxidation and residue, wire brush and spot prime with two coats of primer.
- G. Hoistway entrances: Coordinate the entrance work with that of the trades responsible for furnishing and installing the structural enclosure. Ensure that the entire front wall of the hoistway is left open (or a rough opening is provided which is 12 inches greater in width and 6 inches greater in height than the finished opening) until the hoistway entrances have been installed.

July 11, 2018

1. Install the hoistway entrances in perfect alignment with the guide rails, after guide rails have been installed and aligned. Interface the hoistway entrances with the surrounding conditions as indicated on the approved shop drawings.
2. Fill hoistway door frames solid with grout.

3.4 TOLERANCES

- A. Guide rail alignment: Plumb and parallel to each other. Align rails vertically with tolerance of 1/16 inch in 100 feet. Secure joints without gaps and file/grind irregularities to a smooth continuous surface.
- B. Cab movement on aligned guide rails: Smooth movement, with no objectionable lateral or oscillating movement or vibration. Ensure equalized pressure of guide shoes on rails.

3.5 TESTS AND ADJUSTMENTS

- A. In addition to other requirements, tests, inspections, and remedies, specified herein, perform the following:
 1. Adjust motors, power conversion unit, brake, controllers, leveling switches, limit switches, stopping switches, door operators, interlocks and safety devices to achieve required performance levels.
 2. After completion of the installation, and prior to the date of Substantial Completion of the General Contract, make necessary arrangements with the Architect, and, in the presence of the Architect, conduct a running speed test with the full maximum load on the elevator, to ensure that the installed elevator meet all specified requirements for speed, capacity, and other requirements contained in this Section.
 3. In the event that the equipment does not meet all requirements of this Section, promptly remove from the premises all work determined by the Architect to be non-conforming. Promptly replace and re-execute the condemned work in accordance with the Contract Documents, bearing all expenses and costs therefore, including the costs of other trades as needed to restore related work destroyed or damaged by such removal and replacement work performed.

3.6 CLEANING

- A. After all work under this Section has been completed and satisfactorily tested, remove all applied packing labels from the various surfaces, thoroughly clean and polish all stainless steel and prefinished surfaces. Touch up all scratches, abrasions, and other surface defects in the prefinished surfaces, using the same material, color, and gloss as used in the prefinishing system.

End of Section

Section 21 00 01
FIRE SUPPRESSION FILED SUB-BID REQUIREMENTS
(FILED SUB-BID REQUIRED)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. The BIDDING REQUIREMENTS, CONTRACT FORMS, and CONTRACT CONDITIONS as listed in the Table of Contents, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Work of this Section requires Filed Sub-Bids and is governed by the provisions of the Massachusetts General Laws (MGL), Public Bidding Law - Chapter 149, Sections 44A to 44J inclusive, as amended, and applicable Sections of the MGL, Public Contract Law - Chapter 30.
- C. Specification requirements for the Filed Sub-Bid "FIRE SUPPRESSION" includes all work of the following listed Specification Sections, in their entirety:
 - 1. Section 21 00 01 – Fire Suppression Filed Sub-Bid Requirements
 - 2. Section 21 05 17 - Sleeves and Sleeve Seals for Fire-Suppression Piping.
 - 3. Section 21 05 18 – Escutcheons for Fire-Suppression Piping.
 - 4. Section 21 05 48.13 – Vibration and Seismic Controls for Fire-Suppression Piping and Equipment.
 - 5. Section 21 05 53 – Identification for Fire-Suppression Piping and Equipment.
 - 6. Section 21 13 13 – Wet Pipe Sprinkler Systems
- D. The work to be completed by the Filed Subcontractor for the work of this Section is shown on the following listed Drawings, not just those pertaining particularly to this Sub-Trade, unless specifically called out otherwise, regardless of where among the Drawings it appears:
 - G-001 TITLE SHEET
 - G-002 CODE SUMMARY, NOTES & DRAWING LIST
 - AD-101 EXISTING & SELECTIVE REMOVAL PLANS
 - A-100 BASEMENT PLAN
 - A-101 FIRST FLOOR PLAN
 - A-102 SECOND FLOOR PLAN
 - A-104 REFLECTIVE CEILING PLANS
 - FP-001 FIRE PROTECTION LEGENDS, NOTES & ABBREVIATIONS
 - FP-002 FIRE PROTECTION DETAILS
 - FP-003 FIRE PROTECTION DETAIL
 - FP-100 FIRE PROTECTION BASEMENT NEW WORK PLAN
 - FP-101 FIRE PROTECTION FIRST FLOOR NEW WORK PLAN
 - FP-102 FIRE PROTECTION SECOND FLOOR NEW WORK PLAN
 - FP-103 FIRE PROTECTION ATTIC NEW WORK PLAN.
- E. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the Work of this Filed Subcontract.

July 11, 2018

F. Filed Sub-Bids for work under this Section shall be for the complete work and shall be submitted electronically to the Awarding Authority at time, and in manner stipulated in the INVITATION TO BID and INSTRUCTIONS TO BIDDERS.

1. Each Bid submittal for work under this Section shall be accompanied with the required bid deposit.

G. Sub Sub-Bid Requirements: NONE REQUIRED UNDER THIS SECTION.

1.2 EXAMINATION OF SITE AND DOCUMENTS

A. 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 (Owner) will not be responsible for errors, omissions and/or charges for extra work arising from General Contractor's or Filed Subcontractor's failure to familiarize themselves with the Contract Documents or existing 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: Bidders are strongly encouraged to attend the Pre-Bid conference; refer to INVITATION TO BID for time and date.

1.3 SEQUENCING

A. Coordinate work of this Filed Subcontract with that of other trades, affecting or affected by this work, and cooperate with the other trades as is necessary to assure the steady progress of work.

B. Do not order or deliver any materials until all schedules and submittals, required in the listed Specification Sections included as part of this Filed Subcontract, have been received and approved by the Architect.

C. Before proceeding with installation work, inspect all project conditions and all work of other trades to assure that all such conditions and work are suitable to satisfactorily receive the work of this Section and notify the Architect in writing of any which are not. Do not proceed further until corrective work has been completed or waived.

PART 2 - PRODUCTS

2.1 SCAFFOLDS AND STAGING

A. General: Filed Subcontractors shall obtain required permits for, and provide scaffolds, staging, and other similar raised platforms, required to access their Work as specified in Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS and herein.

1. Scaffolding and staging required for use by this Filed Subcontractor pursuant to requirements of Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS shall be furnished, erected, maintained in a safe condition, and dismantled when no longer required, by this Filed Sub-Trade requiring such scaffolding.
2. Each Filed Subcontractor is responsible to provide, maintain and remove at dismantling, all tarpaulins and similar protective measures necessary to cover

July 11, 2018

POPE'S TAVERN
ADDITION/RENOVATION
Halifax, Massachusetts

scaffolding for inclement weather conditions other than those required to be provided, maintained and removed by the General Contractor pursuant to MGL (Refer to Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS and as additionally required for dust control).

3. Furnishing portable ladders and mobile platforms of all required heights, which may be necessary to perform the work of this trade, are the responsibility this Filed Subcontractor.

2.2 HOISTING MACHINERY AND EQUIPMENT

- A. All hoisting equipment, rigging equipment, crane services and lift machinery required for the work by this Filed Subcontractor shall be furnished, installed, operated and maintained in safe conditions by this Filed Subcontractor, as referenced under Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS.

PART 3 - EXECUTION (Not Used)

End of Section

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Section 21 05 17

SLEEVES AND SLEEVE SEALS FOR FIRE SUPPRESSION PIPING
(FILED SUB-BID REQUIRED AS PART OF SECTION 21 00 01)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Sub-Bid Requirements: As provided under Section 21 00 01 – Fire Suppression Filed Sub-Bid Requirements and supplemented under the Bidding Requirements, Contract Forms, and Conditions of the Contract, and applicable parts of Division 1 - General Requirements.
 - 1. Work of this Filed Sub-Bid includes all individual specification sections listed in Section 21 00 01.

1.2 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions, Division 0 and Division 1 Specifications Sections, apply to this section.

1.3 SUMMARY

- A. Section Includes:
 - 1. Sleeves.
 - 2. Sleeve-seal systems.
 - 3. Grout.

1.4 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.
- D. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.
- E. Galvanized-Steel-Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

2.2 SLEEVE-SEAL SYSTEMS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Advance Products & Systems, Inc.
 - 2. CALPICO, Inc.
 - 3. Metraflex Company (The).
 - 4. Pipeline Seal and Insulator, Inc.
 - 5. Proco Products, Inc.
- B. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.
 - 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 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, 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.
 - 1. Sleeves are not required for core-drilled holes.
- C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.
 - 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.

2. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.
- D. Install sleeves for pipes passing through interior partitions.
1. Cut sleeves to length for mounting flush with both surfaces.
 2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
 3. 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."
- E. 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 specified in Section 078413 "Penetration Firestopping."

3.2 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.

3.3 SLEEVE AND SLEEVE-SEAL SCHEDULE

- A. Use sleeves and sleeve seals for the following piping-penetration applications:
1. Exterior Concrete Walls above Grade:
 - a. Piping Smaller Than NPS 6: Galvanized-steel wall sleeves.
 - b. Piping NPS 6 and Larger: Galvanized-steel wall sleeves.
 2. Concrete Slabs-on-Grade:
 - a. Piping Smaller Than NPS 6: Galvanized-steel wall sleeves with sleeve-seal system.
 - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
 - b. Piping NPS 6 and Larger: Galvanized-steel wall sleeves with sleeve-seal system
Galvanized-steel-pipe sleeves with sleeve-seal system.
 - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
 3. Concrete Slabs above Grade:
 - a. Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves.

July 11, 2018

POPE'S TAVERN
ADDITION/RENOVATION
Halifax, Massachusetts

b. Piping NPS 6 and Larger: Galvanized-steel-pipe sleeves.

4. Interior Partitions:

a. Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves.

b. Piping NPS 6 and Larger: Galvanized-steel-sheet sleeves.

3.4 CONTRACT CLOSEOUT

A. Provide in accordance with Section 01700 – Contract Closeout

End of Section

SECTION 21 05 18

ESCUTCHEONS FOR FIRE SUPPRESSION PIPING
(FILED SUB-BID REQUIRED AS PART OF SECTION 21 00 01)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Sub-Bid Requirements: As provided under Section 21 00 01 – Fire Suppression Filed Sub-Bid Requirements and supplemented under the Bidding Requirements, Contract Forms, and Conditions of the Contract, and applicable parts of Division 1 - General Requirements.
 - 1. Work of this Filed Sub-Bid includes all individual specification sections listed in Section 21 00 01.

1.2 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions, Division 0 and Division 1 Specifications Sections, apply to this section.

1.3 SUMMARY

- A. Section Includes:
 - 1. Escutcheons.
 - 2. Floor plates.

1.4 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 and rough-brass 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.

2.2 FLOOR PLATES

- A. One-Piece Floor Plates: Cast-iron flange with holes for fasteners.

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.
 - 1. Escutcheons for 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.
 - 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, cast-brass type with polished, chrome-plated finish.
 - g. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, stamped-steel type.
 - 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.
 - j. Bare Piping in Equipment Rooms: One-piece, cast-brass type with polished, chrome-plated finish.
 - k. Bare Piping in Equipment Rooms: One-piece, stamped-steel type.
- C. Install floor plates for piping penetrations of equipment-room floors.
- D. 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.

3.2 FIELD QUALITY CONTROL

- A. Replace broken and damaged escutcheons and floor plates using new materials.

3.3 CONTRACT CLOSEOUT

- A. Provide in accordance with Section 01700 – Contract Closeout

End of Section

SECTION 21 05 48.13

VIBRATION AND SEISMIC CONTROLS FOR FIRE SUPPRESSION PIPING AND EQUIPMENT
(FILED SUB-BID REQUIRED AS PART OF SECTION 21 00 01)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Sub-Bid Requirements: As provided under Section 21 00 01 – Fire Suppression Filed Sub-Bid Requirements and supplemented under the Bidding Requirements, Contract Forms, and Conditions of the Contract, and applicable parts of Division 1 - General Requirements.
 - 1. Work of this Filed Sub-Bid includes all individual specification sections listed in Section 21 00 01.

1.2 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions, Division 0 and Division 1 Specifications Sections, apply to this section.

1.3 SUMMARY

- A. Section Includes:
 - 1. Elastomeric isolation pads.
 - 2. Elastomeric isolation mounts.
 - 3. Seismic-restraint accessories.
 - 4. Mechanical anchor bolts.

1.4 DEFINITIONS

- A. IBC: International Building Code.
- B. ICC-ES: ICC-Evaluation Service.
- C. OSHPD: Office of Statewide Health Planning & Development (for the State of California).

1.5 SUBMITTALS

- A. Product Data: For each type of product.
- B. Delegated-Design Submittal: For each vibration isolation and seismic-restraint device.
 - 1. Include design calculations and details for selecting vibration isolators and seismic restraints complying with performance requirements, design criteria, and analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- C. Qualification Data: For professional engineer.
- D. Welding certificates.

1.6 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 and shall bear anchorage preapproval OPA number from OSHPD, preapproval by ICC-ES, or preapproval by another agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are unavailable, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Seismic-Restraint Loading:
 - 1. Site Class as Defined in the IBC: B.
 - 2. Assigned Seismic Use Group or Building Category as Defined in the IBC: I.
 - a. Component Importance Factor: 1.0.
 - b. Component Response Modification Factor: 1.5.
 - c. Component Amplification Factor: 1.0.

2.2 ELASTOMERIC ISOLATION PADS

- A. Elastomeric Isolation Pads:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Ace Mountings Co., Inc.
 - b. California Dynamics Corporation.
 - c. Isolation Technology, Inc.
 - d. Kinetics Noise Control, Inc.
 - e. Mason Industries, Inc.
 - f. Vibration Eliminator Co., Inc.
 - g. Vibration Isolation.
 - h. Vibration Mountings & Controls, Inc.

2. Fabrication: Single or multiple layers of sufficient durometer stiffness for uniform loading over pad area.
3. Size: Factory or field cut to match requirements of supported equipment.
4. Pad Material: Oil and water resistant with elastomeric properties.
5. Surface Pattern: Ribbed pattern.
6. Infused nonwoven cotton or synthetic fibers.
7. Load-bearing metal plates adhered to pads.

2.3 ELASTOMERIC ISOLATION MOUNTS

A. Double-Deflection, Elastomeric Isolation Mounts:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Ace Mountings Co., Inc.
 - b. California Dynamics Corporation.
 - c. Isolation Technology, Inc.
 - d. Kinetics Noise Control, Inc.
 - e. Mason Industries, Inc.
 - f. Vibration Eliminator Co., Inc.
 - g. Vibration Isolation.
 - h. Vibration Mountings & Controls, Inc.
2. Mounting Plates:
 - a. Top Plate: Encapsulated steel load transfer top plates, factory drilled and threaded with threaded studs or bolts.
 - b. Baseplate: Encapsulated steel bottom plates with holes provided for anchoring to support structure.
3. Elastomeric Material: Molded, oil-resistant rubber, neoprene, or other elastomeric material.

2.4 SEISMIC-RESTRAINT ACCESSORIES

- ### A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Cooper B-Line, Inc.
 2. Kinetics Noise Control, Inc.
 3. Mason Industries, Inc.

4. TOLCO.

- B. Hanger-Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections to hanger rod.
- 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.
- F. 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.

PART 3 - EXECUTION

3.1 VIBRATION CONTROL AND SEISMIC-RESTRAINT DEVICE INSTALLATION

- A. Coordinate the location of embedded connection hardware with supported equipment attachment and mounting points and with requirements for concrete reinforcement and formwork specified in Section 033000 "Cast-in-Place Concrete."
- B. Installation of vibration isolators must not cause any change of position of equipment, piping, or ductwork resulting in stresses or misalignment.
- C. Equipment 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 agency acceptable to authorities having jurisdiction that provides required submittals for component.
- D. Piping Restraints:
 - 1. Comply with requirements in MSS SP-127.
 - 2. Space lateral supports a maximum of 40 feet o.c., and longitudinal supports a maximum of 80 feet o.c.
 - 3. Brace a change of direction longer than 12 feet.
- E. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction that provides required submittals for component.
- F. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.
- G. 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.

H. 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.

I. 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. Set anchors to manufacturer's recommended torque, using a torque wrench.
5. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

3.2 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

A. Install flexible connections in piping where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where the connections terminate with connection to equipment that is anchored to a different structural element from the one supporting the connections as they approach equipment. Comply with requirements in Section 211313 "Wet-Pipe Sprinkler Systems".

3.3 CONTRACT CLOSEOUT

A. Provide in accordance with Section 01700 – Contract Closeout

End of Section

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Section 21 05 53

IDENTIFICATION FOR FIRE SUPPRESSION PIPING AND EQUIPMENT
(FILED SUB-BID REQUIRED AS PART OF SECTION 21 00 01)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Sub-Bid Requirements: As provided under Section 21 00 01 – Fire Suppression Filed Sub-Bid Requirements and supplemented under the Bidding Requirements, Contract Forms, and Conditions of the Contract, and applicable parts of Division 1 - General Requirements.
 - 1. Work of this Filed Sub-Bid includes all individual specification sections listed in Section 21 00 01.

1.2 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions, Division 0 and Division 1 Specifications Sections, apply to this section.

1.3 SUMMARY

- A. Section Includes:
 - 1. Equipment labels.
 - 2. Warning signs and labels.
 - 3. Pipe labels.

1.4 SUBMITTALS

- A. Product Data: For each type of product.
- B. Equipment-Label Schedule: Include a listing of all equipment to be labeled and the proposed content for each label.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

- A. Metal Labels for Equipment:
 - 1. Material and Thickness: Brass, 0.032 inch thick, with predrilled holes for attachment hardware.
 - 2. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
 - 3. Minimum Letter Size: 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.

4. Fasteners: Stainless-steel rivets or self-tapping screws.
 5. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- B. Plastic Labels for Equipment:
1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, with predrilled holes for attachment hardware.
 2. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
 3. Minimum Letter Size: 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.
 4. Fasteners: Stainless-steel rivets or self-tapping screws.
 5. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- C. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), and the Specification Section number and title where equipment is specified.
- D. Equipment-Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules) and the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 WARNING SIGNS AND LABELS

- A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, with predrilled holes for attachment hardware.
- B. Letter Color: Red.
- C. Background Color: White.
- D. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
- E. Minimum Letter Size: 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.
- F. Fasteners: Stainless-steel rivets or self-tapping screws.
- G. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- H. Label Content: Include caution and warning information, plus emergency notification instructions.

2.3 PIPE LABELS

- A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service and showing flow direction.
- B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to partially cover circumference of pipe and to attach to pipe without fasteners or adhesive.
- C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.
- D. Pipe-Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings; pipe size; and an arrow indicating flow direction.
 - 1. Flow-Direction Arrows: Integral with piping-system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
 - 2. Lettering Size: At least 1-1/2 inches high.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 LABEL INSTALLATION

- 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 locations of access panels and doors.
- C. Install or permanently fasten labels on each major item of mechanical equipment.
- D. Locate equipment labels where accessible and visible.
- E. Piping Color-Coding: Painting of piping is specified in Section 09001 Painting Work.
- F. Pipe-Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
 - 1. Near each valve and control device.
 - 2. Near each branch connection excluding short takeoffs. Where flow pattern is not obvious, mark each pipe at branch.
 - 3. Near penetrations through walls, floors, ceilings, and inaccessible 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.

July 11, 2018

POPE'S TAVERN
ADDITION/RENOVATION
Halifax, Massachusetts

7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

3.3 CONTRACT CLOSEOUT

A. Provide in accordance with Section 01700 – Contract Closeout

End of Section

Section 21 13 13

WET PIPE SPRINKLER SYSTEMS
(FILED SUB-BID REQUIRED AS PART OF SECTION 21 00 01)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Sub-Bid Requirements: As provided under Section 21 00 01 – Fire Suppression Filed Sub-Bid Requirements and supplemented under the Bidding Requirements, Contract Forms, and Conditions of the Contract, and applicable parts of Division 1 - General Requirements.
 - 1. Work of this Filed Sub-Bid includes all individual specification sections listed in Section 21 00 01.

1.2 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions, Division 0 and Division 1 Specifications Sections, apply to this section.

1.3 SUMMARY

- A. Section Includes:
 - 1. Pipes, fittings, and specialties.
 - 2. Fire-protection valves.
 - 3. Fire-department connections.
 - 4. Sprinklers.
 - 5. Alarm devices.
 - 6. Pressure gages.

1.4 SYSTEM DESCRIPTIONS

- A. Wet-Pipe Sprinkler System: Automatic sprinklers are attached to piping containing water and that is connected to water supply through alarm valve. Water discharges immediately from sprinklers when they are opened. Sprinklers open when heat melts fusible link or destroys frangible device. Hose connections are included if indicated.

1.5 PERFORMANCE REQUIREMENTS

- A. Standard-Pressure Piping System Component: Listed for 175-psig minimum working pressure.
- B. Delegated Design: Design sprinkler system(s), including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- C. Sprinkler system design shall be approved by authorities having jurisdiction.

1. Margin of Safety for Available Water Flow and Pressure: 10 percent, including losses through water-service piping, valves, and backflow preventers.
 2. Sprinkler Occupancy Hazard Classifications:
 - a. Electrical Equipment Rooms: Ordinary Hazard, Group 1.
 - b. Mechanical Equipment Rooms: Ordinary Hazard, Group 1.
 - c. Office and Public Areas: Light Hazard.
 3. Minimum Density for Automatic-Sprinkler Piping Design:
 - a. Light-Hazard Occupancy: 0.10 gpm over 1500-sq. ft. area.
 - b. Ordinary-Hazard, Group 1 Occupancy: 0.15 gpm over 1500-sq. ft. area.
 4. Maximum Protection Area per Sprinkler: Per UL listing.
 5. Maximum Protection Area per Sprinkler:
 - a. Office Spaces and public areas: 225 sq. ft.
 - b. Mechanical Equipment Rooms: 130 sq. ft.
 - c. Electrical Equipment Rooms: 130 sq. ft.
 - d. Other Areas: According to NFPA 13 recommendations unless otherwise indicated.
 6. Total Combined Hose-Stream Demand Requirement: According to NFPA 13 unless otherwise indicated:
 - a. Light-Hazard Occupancies: 100 gpm for 30 minutes.
- D. Seismic Performance: Sprinkler piping shall withstand the effects of earthquake motions determined according to NFPA 13 and ASCE/SEI 7.

1.6 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For wet-pipe sprinkler systems. Include plans, elevations, sections, details, and attachments to other work.
 1. Wiring Diagrams: For power, signal, and control wiring.
- C. Delegated-Design Submittal: For sprinkler systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- D. Qualification Data: For qualified Installer and professional engineer.
- E. Approved Sprinkler Piping Drawings: Working plans, prepared according to NFPA 13, that have been approved by authorities having jurisdiction, including hydraulic calculations if applicable.

- F. Welding certificates.
- G. Field Test Reports and Certificates: Indicate and interpret test results for compliance with performance requirements and as described in NFPA 13. Include "Contractor's Material and Test Certificate for Aboveground Piping."
- H. Field quality-control reports.
- I. Operation and maintenance data.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications:
 - 1. Installer's responsibilities include designing, fabricating, and installing sprinkler systems and providing professional engineering services needed to assume engineering responsibility. Base calculations on results of fire-hydrant flow test.
 - a. Engineering Responsibility: Preparation of working plans, calculations, and field test reports by a qualified professional engineer.
- B. Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.
- 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. NFPA Standards: Sprinkler system equipment, specialties, accessories, installation, and testing shall comply with the following:
 - 1. NFPA 13, "Installation of Sprinkler Systems."
 - 2. NFPA 24, "Installation of Private Fire Service Mains and Their Appurtenances."

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, and fitting materials, and for joining methods for specific services, service locations, and pipe sizes.

2.2 STEEL PIPE AND FITTINGS

- A. Standard Weight, Galvanized- and Black-Steel Pipe: ASTM A 53/A 53M, Type E, Grade B. Pipe ends may be factory or field formed to match joining method.
- B. Schedule 30, Galvanized- and Black-Steel Pipe: ASTM A 135; ASTM A 795/A 795M, Type E; or ASME B36.10M, wrought steel; with wall thickness not less than Schedule 30 and not more than Schedule 40. Pipe ends may be factory or field formed to match joining method.
- C. Thinwall Galvanized- and Black-Steel Pipe: ASTM A 135 or ASTM A 795/A 795M, threadable, with wall thickness less than Schedule 30 and equal to or greater than Schedule 10. Pipe ends may be factory or field formed to match joining method.

- D. Schedule 5 Steel Pipe: ASTM A 135 or ASTM A 795/A 795M, lightwall, with plain ends.
- E. Galvanized- and Black-Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M, standard-weight, seamless steel pipe with threaded ends.
- F. Galvanized and Uncoated, Steel Couplings: ASTM A 865, threaded.
- G. Galvanized and Uncoated, Gray-Iron Threaded Fittings: ASME B16.4, Class 125, standard pattern.
- H. Malleable- or Ductile-Iron Unions: UL 860.
- I. Cast-Iron Flanges: ASME 16.1, Class 125.
- J. Steel Flanges and Flanged Fittings: ASME B16.5, Class 150.
- K. Steel Welding Fittings: ASTM A 234/A 234M and ASME B16.9.
- L. Grooved-Joint, Steel-Pipe Appurtenances:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Anvil International, Inc.
 - b. Corcoran Piping System Co.
 - c. National Fittings, Inc.
 - d. Shurjoint Piping Products.
 - e. Tyco Fire & Building Products LP.
 - f. Victaulic Company.
 - 2. Pressure Rating: 175 psig minimum.
 - 3. Galvanized and Uncoated, Grooved-End Fittings for Steel Piping: ASTM A 47/A 47M, malleable-iron casting or ASTM A 536, ductile-iron casting; with dimensions matching steel pipe.
 - 4. Grooved-End-Pipe Couplings for Steel Piping: AWWA C606 and UL 213, rigid pattern, unless otherwise indicated, for steel-pipe dimensions. Include ferrous housing sections, EPDM-rubber gasket, and bolts and nuts.
- M. Steel Pressure-Seal Fittings: UL 213, FM-approved, 175-psig pressure rating with steel housing, rubber O-rings, and pipe stop; for use with fitting manufacturers' pressure-seal tools.

2.3 PIPING JOINING MATERIALS

- A. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8 inch thick or ASME B16.21, nonmetallic and asbestos free.
 - 1. Class 125, Cast-Iron Flat-Face Flanges: Full-face gaskets.
- B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

- C. Welding Filler Metals: Comply with AWS D10.12M/D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

2.4 LISTED FIRE-PROTECTION VALVES

A. General Requirements:

- 1. Valves shall be UL listed or FM approved.
- 2. Minimum Pressure Rating: 175 psig.

B. Check Valves:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. AFAC Inc.
 - b. American Cast Iron Pipe Company; Waterous Company Subsidiary.
 - c. Anvil International, Inc.
 - d. Clow Valve Company; a division of McWane, Inc.
 - e. Crane Co.; Crane Valve Group; Crane Valves.
 - f. Crane Co.; Crane Valve Group; Jenkins Valves.
 - g. Crane Co.; Crane Valve Group; Stockham Division.
 - h. Fire-End & Croker Corporation.
 - i. Fire Protection Products, Inc.
 - j. Fivalco Inc.
 - k. Globe Fire Sprinkler Corporation.
 - l. Groeniger & Company.
 - m. Kennedy Valve; a division of McWane, Inc.
 - n. Matco-Norca.
 - o. Metraflex, Inc.
 - p. Milwaukee Valve Company.
 - q. Mueller Co.; Water Products Division.
 - r. NIBCO INC.
 - s. Potter Roemer.
 - t. Reliable Automatic Sprinkler Co., Inc.
 - u. Shurjoint Piping Products.

- v. Tyco Fire & Building Products LP.
 - w. United Brass Works, Inc.
 - x. Venus Fire Protection Ltd.
 - y. Victaulic Company.
 - z. Viking Corporation.
 - aa. Watts Water Technologies, Inc.
- 2. Standard: UL 312.
 - 3. Pressure Rating: 300 psig.
 - 4. Type: Swing check.
 - 5. Body Material: Cast iron.
 - 6. End Connections: Flanged or grooved.
- C. Iron OS&Y Gate Valves:
- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Cast Iron Pipe Company; Waterous Company Subsidiary.
 - b. American Valve, Inc.
 - c. Clow Valve Company; a division of McWane, Inc.
 - d. Crane Co.; Crane Valve Group; Crane Valves.
 - e. Crane Co.; Crane Valve Group; Jenkins Valves.
 - f. Crane Co.; Crane Valve Group; Stockham Division.
 - g. Hammond Valve.
 - h. Milwaukee Valve Company.
 - i. Mueller Co.; Water Products Division.
 - j. NIBCO INC.
 - k. Shurjoint Piping Products.
 - l. Tyco Fire & Building Products LP.
 - m. United Brass Works, Inc.
 - n. Watts Water Technologies, Inc.
 - 2. Standard: UL 262.

3. Pressure Rating: 300 psig.
4. Body Material: Cast or ductile iron.
5. End Connections: Flanged or grooved.

D. Indicating-Type Butterfly Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Anvil International, Inc.
 - b. Fivalco Inc.
 - c. Global Safety Products, Inc.
 - d. Kennedy Valve; a division of McWane, Inc.
 - e. Milwaukee Valve Company.
 - f. NIBCO INC.
 - g. Shurjoint Piping Products.
 - h. Tyco Fire & Building Products LP.
 - i. Victaulic Company.
2. Standard: UL 1091.
3. Pressure Rating: 175 psig minimum.
4. Valves NPS 2 and Smaller:
 - a. Valve Type: Ball or butterfly.
 - b. Body Material: Bronze.
 - c. End Connections: Threaded.
5. Valves NPS 2-1/2 and Larger:
 - a. Valve Type: Butterfly.
 - b. Body Material: Cast or ductile iron.
 - c. End Connections: Flanged, grooved, or wafer.
6. Valve Operation: Integral electrical, 115-V ac, prewired, single-circuit, supervisory switch indicating device.

2.5 TRIM AND DRAIN VALVES

A. General Requirements:

1. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
 2. Minimum Pressure Rating: 175 psig.
- B. Ball Valves:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Affiliated Distributors.
 - b. Anvil International, Inc.
 - c. Barnett.
 - d. Conbraco Industries, Inc.; Apollo Valves.
 - e. Fire-End & Croker Corporation.
 - f. Fire Protection Products, Inc.
 - g. Flowserve.
 - h. FNW.
 - i. Jomar International, Ltd.
 - j. Kennedy Valve; a division of McWane, Inc.
 - k. Kitz Corporation.
 - l. Legend Valve.
 - m. Metso Automation USA Inc.
 - n. Milwaukee Valve Company.
 - o. NIBCO INC.
 - p. Potter Roemer.
 - q. Red-White Valve Corporation.
 - r. Southern Manufacturing Group.
 - s. Stewart, M. A. and Sons Ltd.
 - t. Tyco Fire & Building Products LP.
 - u. Victaulic Company.
 - v. Watts Water Technologies, Inc.

2.6 SPECIALTY VALVES

- A. General Requirements:

1. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
 2. Minimum Pressure Rating: 175 psig.
 3. Body Material: Cast or ductile iron.
 4. Size: Same as connected piping.
 5. End Connections: Flanged or grooved.
- B. Alarm Valves:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. AFAC Inc.
 - b. Globe Fire Sprinkler Corporation.
 - c. Reliable Automatic Sprinkler Co., Inc.
 - d. Tyco Fire & Building Products LP.
 - e. Venus Fire Protection Ltd.
 - f. Victaulic Company.
 - g. Viking Corporation.
 2. Standard: UL 193.
 3. Design: For horizontal or vertical installation.
 4. Include trim sets for bypass, drain, electrical sprinkler alarm switch, pressure gages, retarding chamber, and fill-line attachment with strainer.
 5. Drip Cup Assembly: Pipe drain without valves and separate from main drain piping.
 6. Drip Cup Assembly: Pipe drain with check valve to main drain piping.
- C. Automatic (Ball Drip) Drain Valves:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. AFAC Inc.
 - b. Reliable Automatic Sprinkler Co., Inc.
 - c. Tyco Fire & Building Products LP.
 2. Standard: UL 1726.
 3. Pressure Rating: 175 psig minimum.

4. Type: Automatic draining, ball check.
5. Size: NPS 3/4.
6. End Connections: Threaded.

2.7 FIRE-DEPARTMENT CONNECTIONS

A. Flush-Type, Fire-Department Connection:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. AFAC Inc.
 - b. Elkhart Brass Mfg. Company, Inc.
 - c. GMR International Equipment Corporation.
 - d. Guardian Fire Equipment, Inc.
 - e. Potter Roemer.
2. Standard: UL 405.
3. Type: Flush, for wall mounting.
4. Pressure Rating: 175 psig minimum.
5. Body Material: Corrosion-resistant metal.
6. Inlets: Brass with threads according to NFPA 1963 and matching local fire-department sizes and threads. Include extension pipe nipples, brass lugged swivel connections, and check devices or clappers.
7. Caps: Brass, lugged type, with gasket and chain.
8. Escutcheon Plate: Rectangular, brass, wall type.
9. Outlet: With pipe threads.
10. Body Style: Horizontal.
11. Number of Inlets: Two.
12. Escutcheon Plate Marking: Similar to "AUTO SPKR."
13. Finish: Rough brass or bronze.
14. Outlet Size: NPS 4.

2.8 SPRINKLER SPECIALTY PIPE FITTINGS

A. Branch Outlet Fittings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Anvil International, Inc.
 - b. National Fittings, Inc.
 - c. Shurjoint Piping Products.
 - d. Tyco Fire & Building Products LP.
 - e. Victaulic Company.
 2. Standard: UL 213.
 3. Pressure Rating: 175 psig minimum.
 4. Body Material: Ductile-iron housing with EPDM seals and bolts and nuts.
 5. Type: Mechanical-T and -cross fittings.
 6. Configurations: Snap-on and strapless, ductile-iron housing with branch outlets.
 7. Size: Of dimension to fit onto sprinkler main and with outlet connections as required to match connected branch piping.
 8. Branch Outlets: Grooved, plain-end pipe, or threaded.
- B. Flow Detection and Test Assemblies:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. AGF Manufacturing Inc.
 - b. Reliable Automatic Sprinkler Co., Inc.
 - c. Tyco Fire & Building Products LP.
 - d. Victaulic Company.
 2. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
 3. Pressure Rating: 175 psig minimum.
 4. Body Material: Cast- or ductile-iron housing with orifice, sight glass, and integral test valve.
 5. Size: Same as connected piping.
 6. Inlet and Outlet: Threaded.
- C. Branch Line Testers:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Elkhart Brass Mfg. Company, Inc.
 - b. Fire-End & Croker Corporation.
 - c. Potter Roemer.
2. Standard: UL 199.
 3. Pressure Rating: 175 psig minimum.
 4. Body Material: Brass.
 5. Size: Same as connected piping.
 6. Inlet: Threaded.
 7. Drain Outlet: Threaded and capped.
 8. Branch Outlet: Threaded, for sprinkler.
- D. Sprinkler Inspector's Test Fittings:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. AGF Manufacturing Inc.
 - b. Triple R Specialty.
 - c. Tyco Fire & Building Products LP.
 - d. Victaulic Company.
 - e. Viking Corporation.
 2. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
 3. Pressure Rating: 175 psig minimum.
 4. Body Material: Cast- or ductile-iron housing with sight glass.
 5. Size: Same as connected piping.
 6. Inlet and Outlet: Threaded.
- E. Adjustable Drop Nipples:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. CECA, LLC.
 - b. Corcoran Piping System Co.
 - c. Merit Manufacturing; a division of Anvil International, Inc.

2. Standard: UL 1474.
3. Pressure Rating: 300 psig.
4. Body Material: Steel pipe with EPDM-rubber O-ring seals.
5. Size: Same as connected piping.
6. Length: Adjustable.
7. Inlet and Outlet: Threaded.

2.9 SPRINKLERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. AFAC Inc.
 2. Globe Fire Sprinkler Corporation.
 3. Reliable Automatic Sprinkler Co., Inc.
 4. Tyco Fire & Building Products LP.
 5. Venus Fire Protection Ltd.
 6. Victaulic Company.
 7. Viking Corporation.
- B. General Requirements:
 1. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
 2. Pressure Rating for Automatic Sprinklers: 175 psig minimum.
- C. Automatic Sprinklers with Heat-Responsive Element:
 1. Nonresidential Applications: UL 199.
 2. Characteristics: Nominal 1/2-inch orifice with Discharge Coefficient K of 5.6, and for "Ordinary" temperature classification rating unless otherwise indicated or required by application.
- D. Sprinkler Finishes:
 1. Chrome plated.
 2. Bronze.
 3. Painted.
- E. Special Coatings:
 1. Wax.

2. Lead.
 3. Corrosion-resistant paint.
- F. Sprinkler Escutcheons: Materials, types, and finishes for the following sprinkler mounting applications. Escutcheons for concealed, flush, and recessed-type sprinklers are specified with sprinklers.
1. Ceiling Mounting: Plastic, white finish, one piece, flat.
 2. Sidewall Mounting: Plastic, white finish, one piece, flat.
- G. Sprinkler Guards:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Reliable Automatic Sprinkler Co., Inc.
 - b. Tyco Fire & Building Products LP.
 - c. Victaulic Company.
 - d. Viking Corporation.
 2. Standard: UL 199.
 3. Type: Wire cage with fastening device for attaching to sprinkler.

2.10 ALARM DEVICES

- A. Alarm-device types shall match piping and equipment connections.
- B. Water-Motor-Operated Alarm:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Globe Fire Sprinkler Corporation.
 - b. Tyco Fire & Building Products LP.
 - c. Victaulic Company.
 - d. Viking Corporation.
 2. Standard: UL 753.
 3. Type: Mechanically operated, with Pelton wheel.
 4. Alarm Gong: Cast aluminum with red-enamel factory finish.
 5. Size: 10-inch diameter.
 6. Components: Shaft length, bearings, and sleeve to suit wall construction.
 7. Inlet: NPS 3/4.

8. Outlet: NPS 1 drain connection.

C. Water-Flow Indicators:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ADT Security Services, Inc.
 - b. McDonnell & Miller; ITT Industries.
 - c. Potter Electric Signal Company.
 - d. System Sensor; a Honeywell company.
 - e. Viking Corporation.
 - f. Watts Industries (Canada) Inc.
2. Standard: UL 346.
3. Water-Flow Detector: Electrically supervised.
4. Components: Two single-pole, double-throw circuit switches for isolated alarm and auxiliary contacts, 7 A, 125-V ac and 0.25 A, 24-V dc; complete with factory-set, field-adjustable retard element to prevent false signals and tamperproof cover that sends signal if removed.
5. Type: Paddle operated.
6. Pressure Rating: 250 psig.
7. Design Installation: Horizontal or vertical.

D. Valve Supervisory Switches:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Fire-Lite Alarms, Inc.; a Honeywell company.
 - b. Kennedy Valve; a division of McWane, Inc.
 - c. Potter Electric Signal Company.
 - d. System Sensor; a Honeywell company.
2. Standard: UL 346.
3. Type: Electrically supervised.
4. Components: Single-pole, double-throw switch with normally closed contacts.
5. Design: Signals that controlled valve is in other than fully open position.

2.11 PRESSURE GAGES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. AMETEK; U.S. Gauge Division.
 - 2. Ashcroft, Inc.
 - 3. Brecco Corporation.
 - 4. WIKA Instrument Corporation.
- B. Standard: UL 393.
- C. Dial Size: 3-1/2- to 4-1/2-inch diameter.
- D. Pressure Gage Range: 0 to 300 psig.
- E. Water System Piping Gage: Include "WATER" or "AIR/WATER" label on dial face.
- F. Air System Piping Gage: Include retard feature and "AIR" or "AIR/WATER" label on dial face.

PART 3 - EXECUTION

3.1 SERVICE-ENTRANCE PIPING

- A. Connect sprinkler piping to water-service piping 10' from the outside face of the building wall in locations and pipe sizes indicated for service entrance to building. Comply with requirements for exterior piping in Section 211100 "Facility Fire-Suppression Water-Service Piping."
 - 1. Coordinate sprinkler service entry with site contractor.
- B. Install shutoff valve, backflow preventer, pressure gage, drain, and other accessories indicated at connection to water-service piping.
- C. Install shutoff valve, check valve, pressure gage, and drain at connection to water service.

3.2 PIPING INSTALLATION

- A. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated, as far as practical.
 - 1. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with Architect before deviating from approved working plans.
- B. Piping Standard: Comply with requirements for installation of sprinkler piping in NFPA 13.
- C. Install seismic restraints on piping. Comply with requirements for seismic-restraint device materials and installation in NFPA 13.
- D. Use listed fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.

- E. Install unions adjacent to each valve in pipes NPS 2 and smaller.
- F. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.
- G. Install "Inspector's Test Connections" in sprinkler system piping, complete with shutoff valve, and sized and located according to NFPA 13.
- H. Install sprinkler piping with drains for complete system drainage.
- I. Install automatic (ball drip) drain valve at each check valve for fire-department connection, to drain piping between fire-department connection and check valve. Install drain piping to and spill over floor drain or to outside building.
- J. Install alarm devices in piping systems.
- K. Install hangers and supports for sprinkler system piping according to NFPA 13. Comply with requirements for hanger materials in NFPA 13.
- L. Install pressure gages on riser or feed main, at each sprinkler test connection. Include pressure gages with connection not less than NPS 1/4 and with soft metal seated globe valve, arranged for draining pipe between gage and valve. Install gages to permit removal, and install where they will not be subject to freezing.
- M. Fill sprinkler system piping with water.
- N. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 210517 "Sleeves and Sleeve Seals for Fire-Suppression Piping."
- O. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 210518 "Escutcheons for Fire-Suppression Piping."

3.3 JOINT CONSTRUCTION

- A. Install couplings, flanges, flanged fittings, unions, nipples, and transition and special fittings that have finish and pressure ratings same as or higher than system's pressure rating for aboveground applications unless otherwise indicated.
- B. Install unions adjacent to each valve in pipes NPS 2 and smaller.
- C. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.
- D. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- E. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
- F. Flanged Joints: Select appropriate gasket material in size, type, and thickness suitable for water service. Join flanges with gasket and bolts according to ASME B31.9.
- G. 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.
 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
- H. Twist-Locked Joints: Insert plain end of steel pipe into plain-end-pipe fitting. Rotate retainer lugs one-quarter turn or tighten retainer pin.
- I. Steel-Piping, Pressure-Sealed Joints: Join lightwall steel pipe and steel pressure-seal fittings with tools recommended by fitting manufacturer.
- J. Welded Joints: Construct joints according to AWS D10.12M/D10.12, using qualified processes and welding operators according to "Quality Assurance" Article.
1. Shop weld pipe joints where welded piping is indicated. Do not use welded joints for galvanized-steel pipe.
- K. Steel-Piping, Cut-Grooved Joints: Cut square-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe joints.
- L. Steel-Piping, Roll-Grooved Joints: Roll rounded-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe grooved joints.
- M. Steel-Piping, Pressure-Sealed Joints: Join Schedule 5 steel pipe and steel pressure-seal fittings with tools recommended by fitting manufacturer.
- N. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

3.4 VALVE AND SPECIALTIES INSTALLATION

- A. Install listed fire-protection valves, trim and drain valves, specialty valves and trim, controls, and specialties according to NFPA 13 and authorities having jurisdiction.
- B. Install listed fire-protection shutoff valves supervised open, located to control sources of water supply except from fire-department connections. Install permanent identification signs indicating portion of system controlled by each valve.
- C. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water-supply sources.
- D. Specialty Valves:
1. General Requirements: Install in vertical position for proper direction of flow, in main supply to system.
 2. Alarm Valves: Include bypass check valve and retarding chamber drain-line connection.

3.5 SPRINKLER INSTALLATION

- A. Install sprinklers in suspended ceilings in center of acoustical ceiling panels.

July 11, 2018

3.6 FIRE-DEPARTMENT CONNECTION INSTALLATION

- A. Install wall-type, fire-department connections.
- B. Install automatic (ball drip) drain valve at each check valve for fire-department connection.

3.7 IDENTIFICATION

- A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13.
- B. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.8 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
 - 1. Leak Test: After installation, charge systems and test for leaks. Repair leaks and retest until no leaks exist.
 - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 - 3. Flush, test, and inspect sprinkler systems according to NFPA 13, "Systems Acceptance" Chapter.
 - 4. Energize circuits to electrical equipment and devices.
 - 5. Coordinate with fire-alarm tests. Operate as required.
 - 6. Coordinate with fire-pump tests. Operate as required.
 - 7. Verify that equipment hose threads are same as local fire-department equipment.
- C. Sprinkler piping system will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

3.9 CLEANING

- A. Clean dirt and debris from sprinklers.
- B. Remove and replace sprinklers with paint other than factory finish.

3.10 PIPING SCHEDULE

- A. Piping between Fire-Department Connections and Check Valves: Galvanized, standard-weight steel pipe with grooved ends; grooved-end fittings; grooved-end-pipe couplings; and grooved joints.
- B. Sprinkler specialty fittings may be used, downstream of control valves, instead of specified fittings.
- C. Wet-pipe sprinkler system, NPS 2 and smaller, shall be one of the following:

1. Standard-weight or Schedule 30, black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.
 2. Standard-weight or Schedule 30, black-steel pipe with plain ends; uncoated, plain-end-pipe fittings; and twist-locked joints.
 3. Standard-weight or Schedule 30, galvanized-steel pipe with plain ends; galvanized, plain-end-pipe fittings; and twist-locked joints.
 4. Standard-weight or Schedule 30, black-steel pipe with cut- or roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
 5. Standard-weight or Schedule 30, galvanized-steel pipe with cut-grooved ends; galvanized, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
 6. Standard-weight or Schedule 30, black-steel pipe with plain ends; steel welding fittings; and welded joints.
- D. Standard-pressure, wet-pipe sprinkler system, NPS 2-1/2 to NPS 6, shall be one of the following:
1. Standard-weight or Schedule 30, black-steel pipe with cut- or roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
 2. Standard-weight or Schedule 30, galvanized-steel pipe with cut-grooved ends; galvanized, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
 3. Standard-weight or Schedule 30, black-steel pipe with plain ends; steel welding fittings; and welded joints.

3.11 SPRINKLER SCHEDULE

- A. Use sprinkler types in subparagraphs below for the following applications:
1. Rooms without Ceilings: Pendent sprinklers.
 2. Rooms with Suspended Ceilings: Concealed sprinklers.
 3. Wall Mounting: Sidewall sprinklers.
- B. Provide sprinkler types in subparagraphs below with finishes indicated.
1. Concealed Sprinklers: Rough brass, with factory-painted white cover plate.
 2. Pendent and Sidewall Sprinklers: Chrome plated in finished spaces exposed to view; rough bronze in unfinished spaces not exposed to view; wax coated where exposed to acids, chemicals, or other corrosive fumes.

July 11, 2018

POPE'S TAVERN
ADDITION/RENOVATION
Halifax, Massachusetts

3.12 CONTRACT CLOSEOUT

A. Provide in accordance with Section 01700 – Contract Closeout

End of Section

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Section 22 00 01
PLUMBING FILED SUB-BID REQUIREMENTS
(FILED SUB-BID REQUIRED)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. The BIDDING REQUIREMENTS, CONTRACT FORMS, and CONTRACT CONDITIONS as listed in the Table of Contents, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Work of this Section requires Filed Sub-Bids and is governed by the provisions of the Massachusetts General Laws (MGL), Public Bidding Law - Chapter 149, Sections 44A to 44J inclusive, as amended, and applicable Sections of the MGL, Public Contract Law - Chapter 30.
- C. Specification requirements for the Filed Sub-Bid "PLUMBING" includes all work of the following listed Specification Sections, in their entirety:
 - 1. Section 22 00 01 – Plumbing Filed Sub-Bid Requirements
 - 2. Section 22 05 13 - Common Motor Requirements for Plumbing Equipment
 - 3. Section 22 05 17 – Sleeves and Sleeve Seals for Plumbing Piping
 - 4. Section 22 05 18 - Escutcheons for Plumbing Piping
 - 5. Section 22 05 19 - Meters and Gages for Plumbing Piping
 - 6. Section 22 05 23 – General Duty Valves for Plumbing Piping
 - 7. Section 22 05 29 - Hangers and Supports for Plumbing Piping and Equipment
 - 8. Section 22 05 48 - Vibration and Seismic Controls for Plumbing Piping and Equipment
 - 9. Section 22 05 53 - Identification for Plumbing Piping and Equipment
 - 10. Section 22 07 19 – Plumbing Piping Insulation
 - 11. Section 22 11 16 - Domestic Water Piping
 - 12. Section 22 11 19 - Domestic Water Piping Specialties
 - 13. Section 22 11 22 – Facility Natural Gas Piping
 - 14. Section 22 11 23 – Domestic Water Pumps
 - 15. Section 22 13 16 - Sanitary Waste and Vent Piping
 - 16. Section 22 13 19 - Sanitary Waste Piping Specialties
 - 17. Section 23 36 00 – Indirect Domestic Water Heater
 - 18. Section 22 42 13.13 - Commercial Water Closets
 - 19. Section 22 42 16.13 - Commercial Lavatories
 - 20. Section 22 42 16.16 - Commercial Sinks
- D. The work to be completed by the Filed Subcontractor for the work of this Section is shown on the following listed Drawings, not just those pertaining particularly to this Sub-Trade, unless specifically called out otherwise, regardless of where among the Drawings it appears:

G-001 TITLE SHEET
G-002 CODE SUMMARY, NOTES & DRAWING LIST
AD-101 EXISTING & SELECTIVE REMOVAL PLANS
A-100 BASEMENT PLAN
A-101 FIRST FLOOR PLAN
A-102 SECOND FLOOR PLAN
A-104 REFLECTIVE CEILING PLANS
A-501 KITCHEN ENLARGED PLAN & INTERIOR ELEVATIONS
A-502 BATHROOM INTERIOR ELEVATIONS
P-001 PLUMBING LEGENDS & NOTES
P-002 PLUMBING SCHEDULES
P-003 PLUMBING DETAILS
P-004 PLUMBING DETAILS
P-100 PLUMBING BASEMENT DEMOLITION PLAN
P-101 PLUMBING FIRST FLOOR DEMOLITION PLAN
P-102 PLUMBING SECOND FLOOR DEMOLITION PLAN
P-200 PLUMBING BASEMENT NEW WORK PLAN
P-200U PLUMBING BASEMENT UNDERGROUND NEW WORK PLAN
P-201 PLUMBING FIRST FLOOR NEW WORK PLAN
P-202 PLUMBING SECOND FLOOR NEW WORK PLAN
P-203 PLUMBING ROOF NEW WORK PLAN

- E. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the Work of this Filed Subcontract.
- F. Filed Sub-Bids for work under this Section shall be for the complete work and shall be submitted electronically to the Awarding Authority at time, and in manner stipulated in the INVITATION TO BID and INSTRUCTIONS TO BIDDERS.
 - 1. Each Bid submittal for work under this Section shall be accompanied with the required bid deposit.
- G. Sub Sub-Bid Requirements: NONE REQUIRED UNDER THIS SECTION.

1.2 EXAMINATION OF SITE AND DOCUMENTS

- A. 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 (Owner) will not be responsible for errors, omissions and/or charges for extra work arising from General Contractor's or Filed Subcontractor's failure to familiarize themselves with the Contract Documents or existing 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: Bidders are strongly encouraged to attend the Pre-Bid conference; refer to INVITATION TO BID for time and date.

July 11, 2018

1.3 SEQUENCING

- A. Coordinate work of this Filed Subcontract with that of other trades, affecting or affected by this work, and cooperate with the other trades as is necessary to assure the steady progress of work.
- B. Do not order or deliver any materials until all schedules and submittals, required in the listed Specification Sections included as part of this Filed Subcontract, have been received and approved by the Architect.
- C. Before proceeding with installation work, inspect all project conditions and all work of other trades to assure that all such conditions and work are suitable to satisfactorily receive the work of this Section and notify the Architect in writing of any which are not. Do not proceed further until corrective work has been completed or waived.

PART 2 - PRODUCTS

2.1 SCAFFOLDS AND STAGING

- A. General: Filed Subcontractors shall obtain required permits for, and provide scaffolds, staging, and other similar raised platforms, required to access their Work as specified in Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS and herein.
 - 1. Scaffolding and staging required for use by this Filed Subcontractor pursuant to requirements of Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS shall be furnished, erected, maintained in a safe condition, and dismantled when no longer required, by this Filed Sub-Trade requiring such scaffolding.
 - 2. Each Filed Subcontractor is responsible to provide, maintain and remove at dismantling, all tarpaulins and similar protective measures necessary to cover scaffolding for inclement weather conditions other than those required to be provided, maintained and removed by the General Contractor pursuant to MGL (Refer to Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS and as additionally required for dust control).
 - 3. Furnishing portable ladders and mobile platforms of all required heights, which may be necessary to perform the work of this trade, are the responsibility this Filed Subcontractor.

2.2 HOISTING MACHINERY AND EQUIPMENT

- A. All hoisting equipment, rigging equipment, crane services and lift machinery required for the work by this Filed Subcontractor shall be furnished, installed, operated and maintained in safe conditions by this Filed Subcontractor, as referenced under Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS.

PART 3 - EXECUTION (Not Used)

End of Section

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Section 22 05 13

COMMON MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT
(FILED SUB-BID REQUIRED AS PART OF SECTION 22 00 01)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Sub-Bid Requirements: As provided under Section 22 00 01 – Plumbing Filed Sub-Bid Requirements and supplemented under the Bidding Requirements, Contract Forms, and Conditions of the Contract, and applicable parts of Division 1 - General Requirements.
 - 1. Work of this Filed Sub-Bid includes all individual specification sections listed in Section 22 00 01.

1.2 SUMMARY

- A. Section includes general requirements for single-phase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on ac power systems up to 600 V 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 NEMA MG 1 unless otherwise indicated.

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 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

Section 22 05 17

SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING
(FILED SUB-BID REQUIRED AS PART OF SECTION 22 00 01)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Sub-Bid Requirements: As provided under Section 22 00 01 – Plumbing Filed Sub-Bid Requirements and supplemented under the Bidding Requirements, Contract Forms, and Conditions of the Contract, and applicable parts of Division 1 - General Requirements.
 - 1. Work of this Filed Sub-Bid includes all individual specification sections listed in Section 22 00 01.

1.2 SUMMARY

- A. Section Includes:
 - 1. Sleeves.
 - 2. Sleeve-seal systems.
 - 3. Grout.

1.3 ACTION SUBMITTALS

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

PART 2 - PRODUCTS

2.1 SLEEVES

- A. Galvanized-Steel Wall Pipes: ASTM A 53/A 53M, Schedule 40, with plain ends and welded steel collar; zinc coated.
- B. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.
- C. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.
- D. Galvanized-Steel-Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

2.2 SLEEVE-SEAL SYSTEMS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Advance Products & Systems, Inc.
 2. CALPICO, Inc.
 3. Metraflex Company (The).
 4. Pipeline Seal and Insulator, Inc.
 5. Proco Products, Inc.
- B. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.
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 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, 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. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.
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.
2. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.
- D. Install sleeves for pipes passing through interior partitions.
 1. Cut sleeves to length for mounting flush with both surfaces.
 2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
 3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint.

3.2 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.

3.3 SLEEVE AND SLEEVE-SEAL SCHEDULE

- A. Use sleeves and sleeve seals for the following piping-penetration applications:
 1. Interior Partitions:
 - a. Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves.
 - b. Piping NPS 6 and Larger: Galvanized-steel-sheet sleeves.

End of Section

Section 22 05 18

ESCUTCHEONS FOR PLUMBING PIPING
(FILED SUB-BID REQUIRED AS PART OF SECTION 22 00 01)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Sub-Bid Requirements: As provided under Section 22 00 01 – Plumbing Filed Sub-Bid Requirements and supplemented under the Bidding Requirements, Contract Forms, and Conditions of the Contract, and applicable parts of Division 1 - General Requirements.
 - 1. Work of this Filed Sub-Bid includes all individual specification sections listed in Section 22 00 01.

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.

2.2 FLOOR PLATES

- A. One-Piece Floor Plates: Cast-iron flange with holes for fasteners.

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.
 - 1. Escutcheons for 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.
 - 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, cast-brass type with polished, chrome-plated finish.
 - g. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, stamped-steel type.
 - 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.
 - j. Bare Piping in Equipment Rooms: One-piece, cast-brass type with polished, chrome-plated finish.
 - k. Bare Piping in Equipment Rooms: One-piece, stamped-steel type.
- C. Install floor plates for piping penetrations of equipment-room floors.
 - D. 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.
- 3.2 FIELD QUALITY CONTROL
- A. Replace broken and damaged escutcheons and floor plates using new materials.

End of Section

Section 22 05 19

METERS AND GAGES FOR PLUMBING PIPING
(FILED SUB-BID REQUIRED AS PART OF SECTION 22 00 01)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Sub-Bid Requirements: As provided under Section 22 00 01 – Plumbing Filed Sub-Bid Requirements and supplemented under the Bidding Requirements, Contract Forms, and Conditions of the Contract, and applicable parts of Division 1 - General Requirements.
 - 1. Work of this Filed Sub-Bid includes all individual specification sections listed in Section 22 00 01.

1.2 SUMMARY

- A. Section Includes:
 - 1. Bimetallic-actuated thermometers.
 - 2. Thermowells.
 - 3. Dial-type pressure gages.
 - 4. Gage attachments.

1.3 ACTION SUBMITTALS

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

1.4 INFORMATIONAL SUBMITTALS

- A. Product certificates.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 BIMETALLIC-ACTUATED THERMOMETERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Ashcroft Inc.
 - 2. Ernst Flow Industries.
 - 3. Marsh Bellofram.
 - 4. Miljoco Corporation.

5. Nanmac Corporation.
 6. Noshok.
 7. Palmer Wahl Instrumentation Group.
 8. REOTEMP Instrument Corporation.
 9. Tel-Tru Manufacturing Company.
 10. Trerice, H. O. Co.
 11. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
 12. Weiss Instruments, Inc.
 13. WIKA Instrument Corporation - USA.
 14. Winters Instruments - U.S.
- B. Standard: ASME B40.200.
- C. Case: Liquid-filled and sealed type(s); stainless steel with 3-inch nominal diameter.
- D. Dial: Nonreflective aluminum with permanently etched scale markings and scales in deg F and deg C.
- E. Connector Type(s): Union joint, adjustable angle, rigid back and rigid bottom, with unified-inch screw threads.
- F. Connector Size: 1/2 inch, with ASME B1.1 screw threads.
- G. Stem: 0.25 or 0.375 inch in diameter; stainless steel.
- H. Window: Plain glass or plastic Insert material.
- 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 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.
 4. Material for Use with Steel Piping: CRES.
 5. Type: Stepped shank unless straight or tapered shank is indicated.

6. External Threads: NPS 1/2, NPS 3/4, or NPS 1, ASME B1.20.1 pipe threads.
7. Internal Threads: 1/2, 3/4, and 1 inch, 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.

2.3 PRESSURE GAGES

A. Direct-Mounted, Metal-Case, Dial-Type Pressure Gages:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. AMETEK, Inc.; U.S. Gauge.
 - b. Ashcroft Inc.
 - c. Ernst Flow Industries.
 - d. Flo Fab Inc.
 - e. Marsh Bellofram.
 - f. Miljoco Corporation.
 - g. Noshok.
 - h. Palmer Wahl Instrumentation Group.
 - i. REOTEMP Instrument Corporation.
 - j. Tel-Tru Manufacturing Company.
 - k. Trerice, H. O. Co.
 - l. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
 - m. Weiss Instruments, Inc.
 - n. WIKA Instrument Corporation - USA.
 - o. Winters Instruments - U.S.
2. Standard: ASME B40.100.
3. Case: Sealed type(s); cast aluminum or drawn steel; 4-1/2-inch nominal diameter.

4. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
5. Pressure Connection: Brass, with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
6. Movement: Mechanical, with link to pressure element and connection to pointer.
7. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi and kPa.
8. Pointer: Dark-colored metal.
9. Window: Glass or plastic.
10. Ring: Metal.
11. Accuracy: Grade A, plus or minus 1 percent of middle half of scale range.

2.4 GAGE ATTACHMENTS

- A. Snubbers: ASME B40.100, brass; with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads and piston-type surge-dampening device. Include extension for use on insulated piping.
- B. Valves: Brass ball, with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install thermowells with socket extending a minimum of 2 inches 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 thermometers in the following locations:
 1. Inlet and outlet of each water heater.
- K. Install pressure gages in the following locations:

1. Building water service entrance into building.
 2. Inlet and outlet of each pressure-reducing valve.
 3. Suction and discharge of each domestic water pump.
- L. Install meters and gages adjacent to machines and equipment to allow service and maintenance of meters, gages, machines, and equipment.
- M. Adjust faces of meters and gages to proper angle for best visibility.

3.2 THERMOMETER SCHEDULE

- A. Thermometers at inlet and outlet of each domestic water heater shall be one of the following:
1. Liquid-filled Sealed, bimetallic-actuated type.
 2. Industrial-style, liquid-in-glass type.
- B. Thermometer stems shall be of length to match thermowell insertion length.

3.3 THERMOMETER SCALE-RANGE SCHEDULE

- A. Scale Range for Domestic Cold-Water Piping: 0 to 150 deg F and minus 20 to plus 70 deg C.
- B. Scale Range for Domestic Hot-Water Piping: 0 to 250 deg F and 0 to 150 deg C.

3.4 PRESSURE-GAGE SCHEDULE

- A. Pressure gages at discharge of each water service into building shall be one of the following:
1. Sealed, direct-mounted, metal case.
 2. Sealed, direct-mounted, plastic case.
- B. Pressure gages at inlet and outlet of each water pressure-reducing valve shall be one of the following:
1. Sealed, direct-mounted, metal case.
 2. Sealed, direct-mounted, plastic case.
- C. Pressure gages at suction and discharge of each domestic water pump shall be one of the following:
1. Sealed, direct-mounted, metal case.
 2. Sealed, direct-mounted, plastic case.

July 11, 2018

POPE'S TAVERN
ADDITION/RENOVATION
Halifax, Massachusetts

3.5 PRESSURE-GAGE SCALE-RANGE SCHEDULE

- A. Scale Range for Water Service Piping: 0 to 200 psi and 0 to 1400 kPa.
- B. Scale Range for Domestic Water Piping: 0 to 200 psi and 0 to 1400 kPa.

End of Section

Section 22 05 23

GENERAL-DUTY VALVES FOR PLUMBING PIPING
(FILED SUB-BID REQUIRED AS PART OF SECTION 22 00 01)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Sub-Bid Requirements: As provided under Section 22 00 01 – Plumbing Filed Sub-Bid Requirements and supplemented under the Bidding Requirements, Contract Forms, and Conditions of the Contract, and applicable parts of Division 1 - General Requirements.
 - 1. Work of this Filed Sub-Bid includes all individual specification sections listed in Section 22 00 01.

1.2 SUMMARY

- A. Section Includes:
 - 1. Brass ball valves.
 - 2. Bronze ball valves.
 - 3. Bronze swing check valves.
 - 4. Iron swing check valves.
- B. Related Sections:
 - 1. Section 220553 "Identification for Plumbing Piping and Equipment" for valve tags and schedules.
 - 2. Section 221116 "Domestic Water Piping" for valves applicable only to this piping.

1.3 ACTION SUBMITTALS

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

1.4 QUALITY ASSURANCE

- A. ASME Compliance: ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
- B. NSF Compliance: NSF 61 for valve materials for potable-water service.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

- A. Refer to valve schedule articles for applications of valves.
- B. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

- C. Valve Sizes: Same as upstream piping unless otherwise indicated.
- D. Valve Actuator Types:
 - 1. Handlever: For quarter-turn valves NPS 6 and smaller except plug valves.
- E. Valves in Insulated Piping: With 2-inch stem extensions and the following features:
 - 1. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.
- F. Valve-End Connections:
 - 1. Flanged: With flanges according to ASME B16.1 for iron valves.
 - 2. Solder Joint: With sockets according to ASME B16.18.
 - 3. Threaded: With threads according to ASME B1.20.1.

2.2 BRASS BALL VALVES

- A. One-Piece, Full-Port, Brass Ball Valves with Brass Trim:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Kitz Corporation.
 - b. Apollo Valves.
 - c. Nibco.
 - 2. Description:
 - a. Standard: MSS SP-110.
 - b. CWP Rating: 400 psig.
 - c. Body Design: One piece.
 - d. Body Material: Forged brass.
 - e. Ends: Threaded.
 - f. Seats: PTFE or TFE.
 - g. Stem: Brass.
 - h. Ball: Chrome-plated brass.
 - i. Port: Full.

2.3 BRONZE BALL VALVES

- A. One-Piece, Full-Port, Bronze Ball Valves with Bronze Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. American Valve, Inc.
 - b. Conbraco Industries, Inc.; Apollo Valves.
 - c. NIBCO INC.
2. Description:
 - a. Standard: MSS SP-110.
 - b. CWP Rating: 400 psig.
 - c. Body Design: One piece.
 - d. Body Material: Bronze.
 - e. Ends: Threaded.
 - f. Seats: PTFE or TFE.
 - g. Stem: Bronze.
 - h. Ball: Chrome-plated brass.
 - i. Port: Full.

2.4 BRONZE SWING CHECK VALVES

A. Class 125, Bronze Swing Check Valves with Bronze Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. American Valve, Inc.
 - b. Crane Co.; Crane Valve Group; Crane Valves.
 - c. Crane Co.; Crane Valve Group; Jenkins Valves.
 - d. Crane Co.; Crane Valve Group; Stockham Division.
 - e. Hammond Valve.
 - f. Kitz Corporation.
 - g. Milwaukee Valve Company.
 - h. NIBCO INC.
 - i. Powell Valves.
 - j. Red-White Valve Corporation.

- k. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
- l. Zy-Tech Global Industries, Inc.

2. Description:

- a. Standard: MSS SP-80, Type 3.
- b. CWP Rating: 200 psig.
- c. Body Design: Horizontal flow.
- d. Body Material: ASTM B 62, bronze.
- e. Ends: Threaded.
- f. Disc: Bronze.

2.5 IRON SWING CHECK VALVES

A. Class 125, Iron Swing Check Valves with Metal Seats:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Crane Co.; Crane Valve Group; Crane Valves.
 - b. Crane Co.; Crane Valve Group; Jenkins Valves.
 - c. Crane Co.; Crane Valve Group; Stockham Division.
 - d. Hammond Valve.
 - e. Kitz Corporation.
 - f. Legend Valve.
 - g. Milwaukee Valve Company.
 - h. NIBCO INC.
 - i. Powell Valves.
 - j. Red-White Valve Corporation.
 - k. Sure Flow Equipment Inc.
 - l. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
 - m. Zy-Tech Global Industries, Inc.
- 2. Description:
 - a. Standard: MSS SP-71, Type I.

- b. CWP Rating: 200 psig.
- c. Body Design: Clear or full waterway.
- d. Body Material: ASTM A 126, gray iron with bolted bonnet.
- e. Ends: Flanged.
- f. Trim: Bronze.
- g. Gasket: Asbestos free.

PART 3 - EXECUTION

3.1 VALVE INSTALLATION

- A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- B. Locate valves for easy access and provide separate support where necessary.
- C. Install valves in horizontal piping with stem at or above center of pipe.
- D. Install valves in position to allow full stem movement.

3.2 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.

3.3 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

- A. If valve applications are not indicated, use the following:
 - 1. Shutoff Service: Ball.
 - 2. Throttling Service: Globe or ball.
 - 3. Pump-Discharge Check Valves:
 - a. NPS 2 and Smaller: Bronze swing check valves with bronze or nonmetallic disc.
 - b. NPS 2-1/2 and Larger for Domestic Water: Iron swing check valves with lever and weight or with spring.
 - c. NPS 2-1/2 and Larger for Sanitary Waste and Storm Drainage: Iron swing check valves with lever and weight or spring.
- 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. Select valves, except wafer types, with the following end connections:
 - 1. For Copper Tubing, NPS 2 and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.

2. For Copper Tubing, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.
3. For Copper Tubing, NPS 5 and Larger: Flanged ends.
4. For Steel Piping, NPS 2 and Smaller: Threaded ends.
5. For Steel Piping, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.
6. For Steel Piping, NPS 5 and Larger: Flanged ends.

3.4 DOMESTIC, HOT- AND COLD-WATER VALVE SCHEDULE

A. Pipe NPS 2-1/2 and Smaller:

1. Bronze and Brass Valves: May be provided with solder-joint ends instead of threaded ends.
2. Ball Valves: One piece, regular port, brass or bronze with brass trim.
3. Bronze Swing Check Valves: Class 125, bronze disc.

End of Section

Section 22 05 29

HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT
(FILED SUB-BID REQUIRED AS PART OF SECTION 22 00 01)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Sub-Bid Requirements: As provided under Section 22 00 01 – Plumbing Filed Sub-Bid Requirements and supplemented under the Bidding Requirements, Contract Forms, and Conditions of the Contract, and applicable parts of Division 1 - General Requirements.
 - 1. Work of this Filed Sub-Bid includes all individual specification sections listed in Section 22 00 01.

1.2 SUMMARY

- A. Section Includes:
 - 1. Metal pipe hangers and supports.
 - 2. Fastener systems.
 - 3. Equipment supports.

1.3 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design 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 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.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show fabrication and installation details and include calculations for the following; include Product Data for components:
 - 1. Equipment supports.

1.5 INFORMATIONAL SUBMITTALS

- A. Welding certificates.

1.6 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: Pregalvanized 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. Stainless-Steel Pipe Hangers and Supports:
 - 1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
 - 2. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
 - 3. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.
- C. 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 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 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.

2.3 EQUIPMENT SUPPORTS

- A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

July 11, 2018

2.4 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, 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. Fastener System Installation:
 - 1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches 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.
- C. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- D. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- E. Install hangers and supports to allow controlled 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.
- F. Install lateral bracing with and supports to prevent swaying.
- G. 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 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.
- H. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- I. 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.
- J. Insulated Piping:
 - 1. Attach clamps and spacers to piping.

- a. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
2. Shield Dimensions for Pipe: Not less than the following:
 - a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
 - b. NPS 4: 12 inches long and 0.06 inch thick.
 - c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
 - d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
 - e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.
3. Pipes NPS 8 and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
4. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.2 EQUIPMENT SUPPORTS

- A. Fabricate structural-steel stands 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 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze equipment supports.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
- C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:
 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 2. Obtain fusion without undercut or overlap.
 3. Remove welding flux immediately.
 4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.4 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.

3.5 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.
- B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.6 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 and attachments for general service applications.
- F. Use stainless-steel pipe hangers and stainless-steel or corrosion-resistant attachments for hostile environment applications.
- G. Use copper-plated pipe hangers and copper or stainless-steel attachments for copper piping and tubing.
- H. Use padded hangers for piping that is subject to scratching.
- I. Use thermal-hanger shield inserts for insulated piping and tubing.
- J. 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.
 - 2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F, pipes NPS 4 to NPS 24, requiring up to 4 inches of insulation.
 - 3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36, requiring clamp flexibility and up to 4 inches of insulation.
 - 4. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
 - 5. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.

6. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
 7. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
 8. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30, from two rods if longitudinal movement caused by expansion and contraction might occur.
 9. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
- K. 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.
 2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.
- L. 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 for heavy loads.
 2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
- M. 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. 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.
 - b. Medium (MSS Type 32): 1500 lb.

- c. Heavy (MSS Type 33): 3000 lb.
- 8. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
- 9. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
- N. 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.
- O. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
 - 2. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
 - 3. 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.
- P. Comply with MSS SP-69 for trapeze pipe-hanger 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

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Section 22 05 48

VIBRATION AND SEISMIC CONTROLS FOR PLUMBING PIPING AND EQUIPMENT
(FILED SUB-BID REQUIRED AS PART OF SECTION 22 00 01)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Sub-Bid Requirements: As provided under Section 22 00 01 – Plumbing Filed Sub-Bid Requirements and supplemented under the Bidding Requirements, Contract Forms, and Conditions of the Contract, and applicable parts of Division 1 - General Requirements.
 - 1. Work of this Filed Sub-Bid includes all individual specification sections listed in Section 22 00 01.

1.2 SUMMARY

- A. Section Includes:
 - 1. Pipe-riser resilient supports.
 - 2. Resilient pipe guides.
 - 3. Elastomeric hangers.
 - 4. Spring hangers.
 - 5. Mechanical anchor bolts.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Delegated-Design Submittal: For each vibration isolation and seismic-restraint device.
 - 1. Include design calculations and details for selecting vibration isolators and seismic restraints complying with performance requirements, design criteria, and analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For professional engineer.
- B. Welding certificates.
- C. Field quality-control reports.

1.5 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 and shall bear anchorage preapproval OPA number from OSHPD, preapproval by ICC-ES, or preapproval by another agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are unavailable, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Seismic-Restraint Loading:
 - 1. Site Class as Defined in the IBC: B.
 - 2. Assigned Seismic Use Group or Building Category as Defined in the IBC: I.
 - a. Component Importance Factor: 1.0.
 - b. Component Response Modification Factor: 1.5.
 - c. Component Amplification Factor: 1.0.
 - 3. Design Spectral Response Acceleration at Short Periods (0.2 Second): .
 - 4. Design Spectral Response Acceleration at 1.0-Second Period: .

2.2 PIPE-RISER RESILIENT SUPPORT

- A. Description: All-directional, acoustical pipe anchor consisting of two steel tubes separated by a minimum 1/2-inch-thick neoprene.
 - 1. Vertical-Limit Stops: Steel and neoprene vertical-limit stops arranged to prevent vertical travel in both directions.
 - 2. Maximum Load Per Support: 500 psig on isolation material providing equal isolation in all directions.

2.3 RESILIENT PIPE GUIDES

- A. Description: Telescopic arrangement of two steel tubes or post and sleeve arrangement separated by a minimum 1/2-inch-thick neoprene.
 - 1. Factory-Set Height Guide with Shear Pin: Shear pin shall be removable and reinsertable to allow for selection of pipe movement. Guides shall be capable of motion to meet location requirements.

2.4 ELASTOMERIC HANGERS

- A. Elastomeric Mount in a Steel Frame with Upper and Lower Steel Hanger Rods: .

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Ace Mountings Co., Inc.
 - b. California Dynamics Corporation.
 - c. Isolation Technology, Inc.
 - d. Kinetics Noise Control, Inc.
 - e. Mason Industries, Inc.
 - f. Vibration Eliminator Co., Inc.
 - g. Vibration Mountings & Controls, Inc.
2. Frame: Steel, fabricated with a connection for an upper threaded hanger rod and an opening on the underside to allow for a maximum of 30 degrees of angular lower hanger-rod misalignment without binding or reducing isolation efficiency.
3. Dampening Element: Molded, oil-resistant rubber, neoprene, or other elastomeric material with a projecting bushing for the underside opening preventing steel to steel contact.

2.5 SPRING HANGERS

- A. Combination Coil-Spring and Elastomeric-Insert Hanger with Spring and Insert in Compression:
 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Ace Mountings Co., Inc.
 - b. California Dynamics Corporation.
 - c. Kinetics Noise Control, Inc.
 - d. Mason Industries, Inc.
 - e. Vibration Eliminator Co., Inc.
 - f. Vibration Isolation.
 - g. Vibration Mountings & Controls, Inc.
 2. 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.
 3. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
 4. Minimum Additional Travel: 50 percent of the required deflection at rated load.
 5. Lateral Stiffness: More than 80 percent of rated vertical stiffness.

6. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
7. Elastomeric Element: Molded, oil-resistant rubber or neoprene. Steel-washer-reinforced cup to support spring and bushing projecting through bottom of frame.
8. Adjustable Vertical Stop: Steel washer with neoprene washer "up-stop" on lower threaded rod.
9. Self-centering hanger-rod cap to ensure concentricity between hanger rod and support spring coil.

PART 3 - EXECUTION

3.1 APPLICATIONS

- A. Multiple Pipe Supports: Secure pipes to trapeze member with clamps approved for application by an agency acceptable to authorities having jurisdiction.
- B. 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 due to seismic forces.
- C. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength is adequate to carry present and future static and seismic loads within specified loading limits.

3.2 VIBRATION CONTROL AND SEISMIC-RESTRAINT DEVICE INSTALLATION

- A. Coordinate the location of embedded connection hardware with supported equipment attachment and mounting points and with requirements for concrete reinforcement and formwork specified in Section 033000 "Cast-in-Place Concrete."
- B. Installation of vibration isolators must not cause any change of position of equipment, piping, or ductwork resulting in stresses or misalignment.
- C. Piping Restraints:
 1. Comply with requirements in MSS SP-127.
 2. Space lateral supports a maximum of 40 feet o.c., and longitudinal supports a maximum of 80 feet o.c.
 3. Brace a change of direction longer than 12 feet.
- D. Install cables so they do not bend across edges of adjacent equipment or building structure.
- E. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction that provides required submittals for component.
- F. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.
- G. 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.

- H. 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.
- I. 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. Set anchors to manufacturer's recommended torque, using a torque wrench.
 - 5. 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 piping where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where the connections terminate with connection to equipment that is anchored to a different structural element from the one supporting the connections as they approach equipment. Comply with requirements in Section 221116 "Domestic Water Piping" for piping flexible connections.

3.4 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. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
 - 2. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless postconnection testing has been approved), and with at least seven days' advance notice.
 - 3. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.
 - 4. Test at least four of each type and size of installed anchors and fasteners selected by Architect.
 - 5. Test to 90 percent of rated proof load of device.
 - 6. Measure isolator restraint clearance.

- 7. Measure isolator deflection.
 - 8. Verify snubber minimum clearances.
 - D. Remove and replace malfunctioning units and retest as specified above.
 - E. Prepare test and inspection reports.
- 3.5 ADJUSTING
- A. Adjust isolators after piping system is at operating weight.

End of Section

Section 22 05 53

IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT
(FILED SUB-BID REQUIRED AS PART OF SECTION 22 00 01)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Sub-Bid Requirements: As provided under Section 22 00 01 – Plumbing Filed Sub-Bid Requirements and supplemented under the Bidding Requirements, Contract Forms, and Conditions of the Contract, and applicable parts of Division 1 - General Requirements.
 - 1. Work of this Filed Sub-Bid includes all individual specification sections listed in Section 22 00 01.

1.2 SUMMARY

- A. Section Includes:
 - 1. Equipment labels.
 - 2. Warning signs and labels.
 - 3. Pipe labels.

1.3 ACTION SUBMITTAL

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

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

- A. Metal Labels for Equipment:
 - 1. Material and Thickness: Brass, 0.032-inch Stainless steel, 0.025-inch Aluminum, 0.032-inch or anodized aluminum, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
 - 2. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
 - 3. Minimum Letter Size: 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.
 - 4. Fasteners: Stainless-steel rivets or self-tapping screws.
 - 5. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- B. Plastic Labels for Equipment:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
 2. Letter Color: Black.
 3. Background Color: White.
 4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
 5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
 6. Minimum Letter Size: 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.
 7. Fasteners: Stainless-steel rivets or self-tapping screws.
 8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- C. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.
- D. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 WARNING SIGNS AND LABELS

- A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
- B. Letter Color: Red.
- C. Background Color: White.
- D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
- E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
- F. Minimum Letter Size: 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.
- G. Fasteners: Stainless-steel rivets or self-tapping screws.
- H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- I. Label Content: Include caution and warning information, plus emergency notification instructions.

2.3 PIPE LABELS

- A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.
- B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.
- C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.
- D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.
 - 1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
 - 2. Lettering Size: At least 1-1/2 inches high.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 EQUIPMENT LABEL INSTALLATION

- A. Install or permanently fasten labels on each major item of mechanical equipment.
- B. Locate equipment labels where accessible and visible.

3.3 PIPE LABEL INSTALLATION

- A. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed 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 inaccessible 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 labels.
- B. Pipe Label Color Schedule:

July 11, 2018

POPE'S TAVERN
ADDITION/RENOVATION
Halifax, Massachusetts

1. Domestic Cold Water Piping:
 - a. Background Color: Blue.
 - b. Letter Color: White.

2. Domestic Hot Water Piping:
 - a. Background Color: Red
 - b. Letter Color: White.

End of Section

Section 22 07 19

PLUMBING PIPING INSULATION
(FILED SUB-BID REQUIRED AS PART OF SECTION 22 00 01)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Sub-Bid Requirements: As provided under Section 22 00 01 – Plumbing Filed Sub-Bid Requirements and supplemented under the Bidding Requirements, Contract Forms, and Conditions of the Contract, and applicable parts of Division 1 - General Requirements.
 - 1. Work of this Filed Sub-Bid includes all individual specification sections listed in Section 22 00 01.

1.2 SUMMARY

- A. Section includes insulating the following plumbing piping services:
 - 1. Domestic hot-water piping.
 - 2. Domestic recirculating hot-water piping.
 - 3. Domestic cold-water piping.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - 1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
 - 2. Detail attachment and covering of heat tracing inside insulation.
 - 3. Detail insulation application at pipe expansion joints for each type of insulation.
 - 4. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
 - 5. Detail removable insulation at piping specialties, equipment connections, and access panels.
 - 6. Detail application of field-applied jackets.
 - 7. Detail application at linkages of control devices.

1.4 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

1.5 QUALITY ASSURANCE

- A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84 by a testing 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.
- B. Comply with the following applicable standards and other requirements specified for miscellaneous components:
 - 1. Supply and Drain Protective Shielding Guards: ICC A117.1.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

- A. Comply with requirements in "Piping Insulation Schedule, General," and "Indoor Piping Insulation Schedule," articles for 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 "Factory-Applied Jackets" Article.
 - 1. Products: Subject to compliance with requirements, provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Pittsburgh Corning Corporation; Foamglas.
 - b. Armacell LLC; Imcoa SS.
 - c. Buckaroos, Inc.; Insulated Saddle Systems.
 - 2. Special-Shaped Insulation: ASTM C 552, Type III.
 - 3. Preformed Pipe Insulation without Jacket: Comply with ASTM C 552, Type II, Class 1.
 - 4. Preformed Pipe Insulation with Factory-Applied ASJ: Comply with ASTM C 552, Type II, Class 2.
 - 5. Factory fabricate shapes according to ASTM C 450 and ASTM C 585.

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.
 - 1. Products: Subject to compliance with requirements, provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 81-84.
 - b. Foamglas Building; PC 56
 - c. Armacell LLC; 520 BLV
 - 2. 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).
 - 3. 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. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
 - 1. Products: Subject to compliance with requirements, provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-82.
 - b. Eagle Bridges - Marathon Industries; 225.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-20.
 - d. Mon-Eco Industries, Inc.; 22-25.
 - 2. 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).
 - 3. 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. PVC Jacket Adhesive: Compatible with PVC jacket.
 - 1. Products: Subject to compliance with requirements, provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:

- a. Dow Corning Corporation; 739, Dow Silicone.
 - b. Johns Manville; Zeston Perma-Weld, CEEL-TITE Solvent Welding Adhesive.
 - c. P.I.C. Plastics, Inc.; Welding Adhesive.
 - d. Speedline Corporation; Polyco VP Adhesive.
2. 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).
 3. 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 SEALANTS

A. Joint Sealants:

1. Joint Sealants for Cellular-Glass Products: Subject to compliance with requirements, provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
 - b. Eagle Bridges - Marathon Industries; 405.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-45.
 - d. Mon-Eco Industries, Inc.; 44-05.
 - e. Pittsburgh Corning Corporation; Pittseal 444.
2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Permanently flexible, elastomeric sealant.
4. Service Temperature Range: Minus 100 to plus 300 deg F.
5. Color: White or gray.
6. 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).
7. 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."

2.4 FIELD-APPLIED JACKETS

- A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.
- B. 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: Subject to compliance with requirements, provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Johns Manville; Zeston.
 - b. P.I.C. Plastics, Inc.; FG Series.
 - c. Proto 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.

2.5 TAPES

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
 1. Products: Subject to compliance with requirements, provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. ABI, Ideal Tape Division; 428 AWF ASJ.
 - b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0836.
 - c. Compac Corporation; 104 and 105.
 - 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.
 1. Products: Subject to compliance with requirements, provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:

- a. ABI, Ideal Tape Division; 491 AWF FSK.
 - b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827.
 - c. Compac Corporation; 110 and 111.
 - d. Venture Tape; 1525 CW NT, 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: Subject to compliance with requirements, provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. ABI, Ideal Tape Division; 370 White PVC tape.
 - b. Compac Corporation; 130.
 - c. 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.

2.6 SECUREMENTS

- A. Aluminum Bands: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide with wing seal or closed seal.
1. Products: Subject to compliance with requirements, provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. ITW Insulation Systems; Gerrard Strapping and Seals.
 - b. RPR Products, Inc.; Insul-Mate Strapping and Seals.
 - c. GLT Products; Aluminum Banding.

- B. Wire: 0.080-inch nickel-copper alloy.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. C & F Wire.
 - b. Southeastern Wire.
 - c. SEMCO Southeastern Metals; Insulation Support Wire.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
- B. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.
- C. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.2 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-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 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 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. Cleanouts.

3.3 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 Underground 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.
- F. Insulation Installation at Floor Penetrations:
1. Pipe: Install insulation continuously through floor penetrations.
 2. Seal penetrations through fire-rated assemblies.

3.4 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 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.

3.5 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 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, 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.

3.6 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 PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints. 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.

C. 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.

3.7 FINISHES

A. Insulation with ASJ or Glass-Cloth:

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.

3.8 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
 - 1. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, 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.
- C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.9 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. Drainage piping located in crawl spaces.
 - 2. Underground piping.
 - 3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.10 INDOOR PIPING INSULATION SCHEDULE

- A. Domestic Hot, Cold, and Recirculated Hot Water: Insulation shall be one of the following:
 - 1. Flexible Elastomeric: 3/4 inch thick.
 - 2. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch thick.
 - 3. Polyolefin: 3/4 inch thick.

End of Section

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Section 22 11 16

DOMESTIC WATER PIPING
(FILED SUB-BID REQUIRED AS PART OF SECTION 22 00 01)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Sub-Bid Requirements: As provided under Section 22 00 01 – Plumbing Filed Sub-Bid Requirements and supplemented under the Bidding Requirements, Contract Forms, and Conditions of the Contract, and applicable parts of Division 1 - General Requirements.
 - 1. Work of this Filed Sub-Bid includes all individual specification sections listed in Section 22 00 01.

1.2 SUMMARY

- A. Section includes aboveground domestic water pipes, tubes, and fittings inside buildings.

1.3 ACTION SUBMITTALS

- A. Product Data: For transition fittings and dielectric fittings.

1.4 INFORMATIONAL SUBMITTALS

- A. System purging and disinfecting activities report.
- B. Field quality-control reports.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.
- B. Potable-water piping and components shall comply with NSF 14 and NSF 61.

2.2 COPPER TUBE AND FITTINGS

- A. Hard Copper Tube: ASTM B 88, Type L water tube, drawn temper.
- B. Soft Copper Tube: ASTM B 88, Type L water tube, annealed temper.
- C. Cast-Copper, Solder-Joint Fittings: ASME B16.18, pressure fittings.
- D. Wrought-Copper, Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.
- E. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.
- F. Copper Unions:
 - 1. MSS SP-123.

2. Cast-copper-alloy, hexagonal-stock body.
3. Ball-and-socket, metal-to-metal seating surfaces.
4. Solder-joint or threaded ends.

G. Copper Pressure-Seal-Joint Fittings:

1. Fittings for NPS 2 and Smaller: Wrought-copper fitting with EPDM-rubber, O-ring seal in each end.
2. Fittings for NPS 2-1/2 to NPS 4: Cast-bronze or wrought-copper fitting with EPDM-rubber, O-ring seal in each end.

2.3 PIPING JOINING MATERIALS

A. Pipe-Flange Gasket Materials:

1. AWWA C110/A21.10, rubber, flat face, 1/8 inch thick or ASME B16.21, nonmetallic and asbestos free unless otherwise indicated.
2. Full-face or ring type unless otherwise indicated.

B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

C. Solder Filler Metals: ASTM B 32, lead-free alloys.

D. Flux: ASTM B 813, water flushable.

E. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.

2.4 TRANSITION FITTINGS

A. General Requirements:

1. Same size as pipes to be joined.
2. Pressure rating at least equal to pipes to be joined.
3. End connections compatible with pipes to be joined.

B. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.

C. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.

D. Dielectric Unions:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Capitol Manufacturing Company; member of the Phoenix Forge Group.
 - b. Central Plastics Company.

- c. Hart Industries International, Inc.
 - d. Jomar International.
 - e. Matco-Norca.
 - f. McDonald, A. Y. Mfg. Co.
 - g. Watts; a division of Watts Water Technologies, Inc.
 - h. Wilkins; a Zurn company.
2. Standard: ASSE 1079.
 3. Pressure Rating: 125 psig minimum at 180 deg F.
 4. End Connections: Solder-joint copper alloy and threaded ferrous.
- E. Dielectric Flanges:
1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Capitol Manufacturing Company; member of the Phoenix Forge Group.
 - b. Central Plastics Company.
 - c. Matco-Norca.
 - d. Watts; a division of Watts Water Technologies, Inc.
 - e. Wilkins; a Zurn company.
 2. Standard: ASSE 1079.
 3. Factory-fabricated, bolted, companion-flange assembly.
 4. Pressure Rating: 125 psig minimum at 180 deg F.
 5. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.
- F. Dielectric-Flange Insulating Kits:
1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Advance Products & Systems, Inc.
 - b. Calpico, Inc.
 - c. Central Plastics Company.
 - d. Pipeline Seal and Insulator, Inc.
 2. Nonconducting materials for field assembly of companion flanges.

3. Pressure Rating: 150 psig.
 4. Gasket: Neoprene or phenolic.
 5. Bolt Sleeves: Phenolic or polyethylene.
 6. Washers: Phenolic with steel backing washers.
- G. Dielectric Nipples:
1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Elster Perfection Corporation.
 - b. Grinnell Mechanical Products; Tyco Fire Products LP.
 - c. Matco-Norca.
 - d. Precision Plumbing Products, Inc.
 - e. Victaulic Company.
 2. Standard: IAPMO PS 66.
 3. Electroplated steel nipple complying with ASTM F 1545.
 4. Pressure Rating and Temperature: 300 psig at 225 deg F.
 5. End Connections: Male threaded or grooved.
 6. Lining: Inert and noncorrosive, propylene.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.
- B. Install shutoff valve immediately upstream of each dielectric fitting.
- C. Install water-pressure-reducing valves downstream from shutoff valves. Comply with requirements for pressure-reducing valves in Section 221119 "Domestic Water Piping Specialties."
- D. Install domestic water piping level without pitch and plumb.
- E. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.
- F. 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.

- G. Install piping to permit valve servicing.
- H. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than the system pressure rating used in applications below unless otherwise indicated.
- I. Install piping free of sags and bends.
- J. Install fittings for changes in direction and branch connections.
- K. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.

3.2 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 pipes, tubes, and fittings before assembly.
- C. 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.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
- D. Brazed Joints for Copper Tubing: Comply with CDA's "Copper Tube Handbook," "Braze Joints" chapter.
- E. Soldered Joints for Copper Tubing: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."
- F. Pressure-Sealed Joints for Copper Tubing: Join copper tube and pressure-seal fittings with tools recommended by fitting manufacturer.
- G. Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for domestic water service. Join flanges with gasket and bolts according to ASME B31.9.
- H. Joints for Dissimilar-Material Piping: Make joints using adapters compatible with materials of both piping systems.

3.3 TRANSITION FITTING INSTALLATION

- A. Install transition couplings at joints of dissimilar piping.

3.4 DIELECTRIC FITTING INSTALLATION

- A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
- B. Dielectric Fittings for NPS 2 and Smaller: Use dielectric couplings or nipples.
- C. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric flanges.

- D. Dielectric Fittings for NPS 5 and Larger: Use dielectric flange kits.

3.5 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements for pipe hanger, support products, and installation in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."
 - 1. Vertical Piping: MSS Type 8 or 42, clamps.
 - 2. Individual, Straight, Horizontal Piping Runs:
 - 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.
- B. Support vertical piping and tubing at base and at each floor.
- C. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch.
- D. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 3/4 and Smaller: 60 inches with 3/8-inch rod.
 - 2. NPS 1 and NPS 1-1/4: 72 inches with 3/8-inch rod.
 - 3. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
 - 4. NPS 2-1/2: 108 inches with 1/2-inch rod.
 - 5. NPS 3 to NPS 5: 10 feet with 1/2-inch rod.
 - 6. NPS 6: 10 feet with 5/8-inch rod.
 - 7. NPS 8: 10 feet with 3/4-inch rod.
- E. Install supports for vertical copper tubing every 10 feet.
- F. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 1-1/4 and Smaller: 84 inches with 3/8-inch rod.
 - 2. NPS 1-1/2: 108 inches with 3/8-inch rod.
 - 3. NPS 2: 10 feet with 3/8-inch rod.
 - 4. NPS 2-1/2: 11 feet with 1/2-inch rod.
 - 5. NPS 3 and NPS 3-1/2: 12 feet with 1/2-inch rod.

- 6. NPS 4 and NPS 5: 12 feet with 5/8-inch rod.
- 7. NPS 6: 12 feet with 3/4-inch rod.
- 8. NPS 8 to NPS 12: 12 feet with 7/8-inch rod.

- G. Install supports for vertical steel piping every 15 feet.
- H. Support piping and tubing not listed in this article according to MSS SP-69 and manufacturer's written instructions.

3.6 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. When installing piping adjacent to equipment and machines, allow space for service and maintenance.

3.7 IDENTIFICATION

- A. Identify system components. Comply with requirements for identification materials and installation in Section 220553 "Identification for Plumbing Piping and Equipment."
- B. Label pressure piping with system operating pressure.

3.8 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. Piping Inspections:
 - a. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
 - b. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:
 - 1) Final Inspection: Arrange for authorities having jurisdiction to observe tests specified in "Piping Tests" Subparagraph below and to ensure compliance with requirements.
 - c. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
 - d. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
 - 2. Piping Tests:
 - a. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
 - b. 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 a separate report for each test, complete with diagram of portion of piping tested.

- c. 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.
 - d. 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 it to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
 - e. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.
 - f. Prepare reports for tests and for corrective action required.
- B. Domestic water piping will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

3.9 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. Open throttling valves to proper setting.
 - 4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.
 - a. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide hot-water flow in each branch.
 - b. Adjust calibrated balancing valves to flows indicated.
 - 5. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
 - 6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
 - 7. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.10 CLEANING

- A. Clean and disinfect potable domestic water piping as follows:
- 1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
 - 2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures 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. Repeat procedures if biological examination shows contamination.
 - e. Submit water samples in sterile bottles to authorities having jurisdiction.
- B. Prepare and submit reports of purging and disinfecting activities. Include copies of water-sample approvals from authorities having jurisdiction.
- C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

3.11 PIPING SCHEDULE

- 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 and unions may be used for aboveground piping joints unless otherwise indicated.
- C. Fitting Option: Extruded-tee connections and brazed joints may be used on aboveground copper tubing.
- D. Aboveground domestic water piping, NPS 2 and smaller, shall be one of the following:
- 1. Galvanized-steel pipe and nipples; galvanized, gray-iron threaded fittings; and threaded joints.
 - 2. Hard copper tube, ASTM B 88, Type L; cast- or wrought-copper, solder-joint fittings; and brazed joints.
 - 3. Hard copper tube, ASTM B 88, Type L; copper pressure-seal-joint fittings; and pressure-sealed joints.
- E. Aboveground domestic water piping, NPS 2-1/2 to NPS 4, shall be one of the following:
- 1. Hard copper tube, ASTM B 88, Type L; cast- or wrought-copper, solder-joint fittings; and brazed joints.
 - 2. Hard copper tube, ASTM B 88, Type L; copper pressure-seal-joint fittings; and pressure-sealed joints.
 - 3. Hard copper tube, ASTM B 88, Type L; grooved-joint, copper-tube appurtenances; and grooved joints.

End of Section

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Section 22 11 19

DOMESTIC WATER PIPING SPECIALTIES
(FILED SUB-BID REQUIRED AS PART OF SECTION 22 00 01)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Sub-Bid Requirements: As provided under Section 22 00 01 – Plumbing Filed Sub-Bid Requirements and supplemented under the Bidding Requirements, Contract Forms, and Conditions of the Contract, and applicable parts of Division 1 - General Requirements.
 - 1. Work of this Filed Sub-Bid includes all individual specification sections listed in Section 22 00 01.

1.2 SUMMARY

- A. Section Includes:
 - 1. Vacuum breakers.
 - 2. Balancing valves.
 - 3. Temperature-actuated, water mixing valves.
 - 4. Strainers.
 - 5. Drain valves.
- B. Related Requirements:
 - 1. Section 220519 "Meters and Gages for Plumbing Piping" for thermometers, pressure gages, and flow meters in domestic water piping.
 - 2. Section 221116 "Domestic Water Piping" for water meters.

1.3 ACTION SUBMITTALS

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

1.4 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PIPING SPECIALTIES

- A. Potable-water piping and components shall comply with NSF 61 and NSF 14. Mark "NSF-pw" on plastic piping components.

2.2 PERFORMANCE REQUIREMENTS

- A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig unless otherwise indicated.

2.3 VACUUM BREAKERS

- A. Pipe-Applied, Atmospheric-Type Vacuum Breakers:
1. Standard: ASSE 1001.
 2. Size: NPS 1/4 to NPS 3, as required to match connected piping.
 3. Body: Bronze.
 4. Inlet and Outlet Connections: Threaded.
 5. Finish: Rough bronze.
- B. Hose-Connection Vacuum Breakers:
1. Standard: ASSE 1011.
 2. Body: Bronze, nonremovable, with manual drain.
 3. Outlet Connection: Garden-hose threaded complying with ASME B1.20.7.
 4. Finish: Rough bronze.

2.4 BALANCING VALVES

- A. Memory-Stop Balancing Valves:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available 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. Crane Co.; Crane Valve Group; Jenkins Valves.
 - d. Crane Co.; Crane Valve Group; Stockham Div.
 - e. Hammond Valve.
 - f. Milwaukee Valve Company.
 - g. NIBCO Inc.
 - h. Red-White Valve Corp.
 2. Standard: MSS SP-110 for two-piece, copper-alloy ball valves.

3. Pressure Rating: 400-psig minimum CWP.
4. Size: NPS 2 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.

2.5 TEMPERATURE-ACTUATED, WATER MIXING VALVES

A. Primary, Thermostatic, Water Mixing Valves:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. Armstrong International, Inc.
 - b. Lawler Manufacturing Company, Inc.
 - c. Leonard Valve Company.
 - d. Symmons Industries, Inc.
2. Standard: ASSE 1017.
3. Pressure Rating: 5 psig minimum unless otherwise indicated.
4. Type: Exposed-mounted, thermostatically controlled, water mixing valve.
5. Material: Bronze body with corrosion-resistant interior components.
6. Connections: Threaded inlets and outlet.
7. Accessories: Manual temperature control, check stops on hot- and cold-water supplies, and adjustable, temperature-control handle.
8. Tempered-Water Setting: 110°F.
9. Selected Valve Flow Rate at 45-psig Pressure Drop: 110 gpm.
10. Valve Finish: Chrome plated.
11. Piping Finish: Copper.

2.6 STRAINERS FOR DOMESTIC WATER PIPING

A. Y-Pattern Strainers:

1. Pressure Rating: 125 psig minimum unless otherwise indicated.

2. Body: Bronze for NPS 2 and smaller; cast iron with interior lining that complies with AWWA C550 or that is FDA approved, epoxy coated and for NPS 2-1/2 and larger.
3. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
4. Screen: Stainless steel with round perforations unless otherwise indicated.
5. Perforation Size:
 - a. Strainers NPS 2 and Smaller: 0.020 inch.
 - b. Strainers NPS 2-1/2 to NPS 4: 0.045 inch.
 - c. Strainers NPS 5 and Larger: 0.10 inch.
6. Drain: Pipe plug.

2.7 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.
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.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install water regulators with inlet and outlet shutoff valves and bypass with memory-stop balancing valve. Install pressure gages on inlet and outlet.
- B. Install balancing valves in locations where they can easily be adjusted.
- C. Install temperature-actuated, water mixing valves with check stops or shutoff valves on inlets and with shutoff valve on outlet.
- D. Install Y-pattern strainers for water on supply side of each control valve, solenoid valve, and pump.

3.2 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. Test each pressure vacuum breaker according to authorities having jurisdiction and the device's reference standard.
- B. Domestic water piping specialties will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

3.3 ADJUSTING

- A. Set field-adjustable flow set points of balancing valves.
- B. Set field-adjustable temperature set points of temperature-actuated, water mixing valves.

End of Section

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Section 22 11 22

FACILITY NATURAL GAS PIPING
(FILED SUB-BID REQUIRED AS PART OF SECTION 22 00 01)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Sub-Bid Requirements: As provided under Section 22 00 01 – Plumbing Filed Sub-Bid Requirements and supplemented under the Bidding Requirements, Contract Forms, and Conditions of the Contract, and applicable parts of Division 1 - General Requirements.
 - 1. Work of this Filed Sub-Bid includes all individual specification sections listed in Section 22 00 01.
- B. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS, which are hereby made a part of this Section of the Specifications.

1.2 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions, Division 0 and Division 1 Specifications Sections, apply to this section.

1.3 SUMMARY

- A. Section Includes:
 - 1. Pipes, tubes, and fittings.
 - 2. Piping specialties.
 - 3. Piping and tubing joining materials.
 - 4. Manual gas shutoff valves.
 - 5. Dielectric unions.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For facility natural-gas piping layout. Include plans, piping layout and elevations, sections, and details for fabrication of pipe anchors, hangers, supports for multiple pipes, alignment guides, expansion joints and loops, and attachments of the same to building structure. Detail location of anchors, alignment guides, and expansion joints and loops.
- C. Delegated-Design Submittal: For natural-gas piping and equipment 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 seismic restraints.
 - 2. Design Calculations: Calculate requirements for selecting seismic restraints.

- D. Welding certificates.
- E. Field quality-control reports.
- F. Operation and maintenance data.

1.5 QUALITY ASSURANCE

- A. Steel Support 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.
- 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.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Minimum Operating-Pressure Ratings:
 - 1. Piping and Valves: 100 psig minimum unless otherwise indicated.
 - 2. Service Regulators: 65 psig minimum unless otherwise indicated.
- B. Natural-Gas System Pressure within Buildings: 4" WC to 14" WC (13.8 kPa).
- C. Delegated Design: Design restraints and anchors for natural-gas piping and equipment, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

2.2 PIPES, TUBES, AND FITTINGS

- A. Steel Pipe: ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.
 - 1. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern.
 - 2. Wrought-Steel Welding Fittings: ASTM A 234/A 234M for butt welding and socket welding.
 - 3. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends.

2.3 PIPING SPECIALTIES

- A. Y-Pattern Strainers:
 - 1. Body: ASTM A 126, Class B, cast iron with bolted cover and bottom drain connection.
 - 2. End Connections: Threaded ends for NPS 2 and smaller.

July 11, 2018

3. Strainer Screen: 40-mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.
 4. CWP Rating: 125 psig.
- B. Weatherproof Vent Cap: Cast- or malleable-iron increaser fitting with corrosion-resistant wire screen, with free area at least equal to cross-sectional area of connecting pipe and threaded-end connection.

2.4 JOINING MATERIALS

- A. Joint Compound and Tape: Suitable for natural gas.
- B. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

2.5 MANUAL GAS SHUTOFF VALVES

- A. See "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles for where each valve type is applied in various services.
- B. General Requirements for Metallic Valves, NPS 2 and Smaller: Comply with ASME B16.33.
1. CWP Rating: 125 psig.
 2. Threaded Ends: Comply with ASME B1.20.1.
 3. Tamperproof Feature: Locking feature for valves indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
 4. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction for valves 1 inch and smaller.
 5. Service Mark: Valves 1-1/4 inches to NPS 2 shall have initials "WOG" permanently marked on valve body.
- C. One-Piece, Bronze Ball Valve with Bronze Trim: MSS SP-110.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. BrassCraft Manufacturing Company; a Masco company.
 - b. Conbraco Industries, Inc.; Apollo Div.
 - c. Lyall, R. W. & Company, Inc.
 - d. McDonald, A. Y. Mfg. Co.
 - e. Perfection Corporation; a subsidiary of American Meter Company.
 2. Body: Bronze, complying with ASTM B 584.

3. Ball: Chrome-plated brass.
4. Stem: Bronze; blowout proof.
5. Seats: Reinforced TFE; blowout proof.
6. Packing: Separate packnut with adjustable-stem packing threaded ends.
7. Ends: Threaded, flared, or socket as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
8. CWP Rating: 600 psig.
9. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
10. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

2.6 DIELECTRIC UNIONS

A. Dielectric Unions:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Capitol Manufacturing Company.
 - b. Central Plastics Company.
 - c. Hart Industries International, Inc.
 - d. Jomar International Ltd.
 - e. Matco-Norca, Inc.
 - f. McDonald, A. Y. Mfg. Co.
 - g. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
 - h. Wilkins; a Zurn company.

PART 3 - EXECUTION

3.1 OUTDOOR PIPING INSTALLATION

- A. Comply with NFPA 54 for installation and purging of natural-gas piping.
- B. Extend natural gas piping 10' from building foundation. Refer to plumbing contract drawings. Plumbing sub-contractor to provide connection to natural gas supply source which is provided by the general contractor.
 1. Coordinate natural-gas service connection with the general contractor and civil drawings.

July 11, 2018

- C. Install underground, natural-gas piping buried at least 36 inches below finished grade. Comply with requirements in Section 312000-Earthwork for excavating, trenching, and backfilling.
 - 1. If natural-gas piping is installed less than 36 inches below finished grade, install it in containment conduit.
- D. Install underground, PE, natural-gas piping according to ASTM D 2774.
- E. Steel Piping with Protective Coating:
 - 1. Apply joint cover kits to pipe after joining to cover, seal, and protect joints.
 - 2. Repair damage to PE coating on pipe as recommended in writing by protective coating manufacturer.
 - 3. Replace pipe having damaged PE coating with new pipe.
- F. Install fittings for changes in direction and branch connections.
- G. Install pressure gage upstream and downstream from each service regulator. Pressure gages are specified in Section 220519-Meters and Gages for Plumbing Piping.

3.2 INDOOR PIPING INSTALLATION

- A. Comply with NFPA 54 for installation and purging of natural-gas piping.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- C. Arrange for pipe spaces, chases, slots, sleeves, and openings in building structure during progress of construction, to allow for mechanical installations.
- D. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- E. 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.
- F. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- G. Locate valves for easy access.
- H. Install natural-gas piping at uniform grade of 2 percent down toward drip and sediment traps.
- I. Install piping free of sags and bends.
- J. Install fittings for changes in direction and branch connections.
- K. Verify final equipment locations for roughing-in.

- L. Comply with requirements in Sections specifying gas-fired appliances and equipment for roughing-in requirements.
 - M. Drips and Sediment Traps: Install drips at points where condensate may collect, including service-meter outlets. Locate where accessible to permit cleaning and emptying. Do not install where condensate is subject to freezing.
 - 1. Construct drips and sediment traps using tee fitting with bottom outlet plugged or capped. Use nipple a minimum length of 3 pipe diameters, but not less than 3 inches long and same size as connected pipe. Install with space below bottom of drip to remove plug or cap.
 - N. Extend relief vent connections for service regulators, line regulators, and overpressure protection devices to outdoors and terminate with weatherproof vent cap.
 - O. Conceal pipe installations in walls, pipe spaces, utility spaces, above ceilings, below grade or floors, and in floor channels unless indicated to be exposed to view.
 - P. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.
 - Q. Connect branch piping from top or side of horizontal piping.
 - R. Install unions in pipes NPS 2 and smaller, adjacent to each valve, at final connection to each piece of equipment.
 - S. Do not use natural-gas piping as grounding electrode.
 - T. Install strainer on inlet of each line-pressure regulator and automatic or electrically operated valve.
 - U. Install pressure gage upstream and downstream from each line regulator. Pressure gages are specified in Section 220519-Meters and Gages for Plumbing Piping.
 - V. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 220517-Sleeves and Sleeve Seals for Plumbing Piping.
 - W. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 220517-Sleeves and Sleeve Seals for Plumbing Piping.
 - X. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 220518-Escutcheons for Plumbing Piping.
- 3.3 VALVE INSTALLATION
- A. Install manual gas shutoff valve for each gas appliance ahead of corrugated stainless-steel tubing or copper connector.
- 3.4 PIPING JOINT CONSTRUCTION
- A. Ream ends of pipes and tubes and remove burrs.

- B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- C. Threaded Joints:
 - 1. Thread pipe with tapered pipe threads complying with ASME B1.20.1.
 - 2. Cut threads full and clean using sharp dies.
 - 3. Ream threaded pipe ends to remove burrs and restore full inside diameter of pipe.
 - 4. Apply appropriate tape or thread compound to external pipe threads unless dryseal threading is specified.
 - 5. 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.
- D. Welded Joints:
 - 1. Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators.
 - 2. Bevel plain ends of steel pipe.
 - 3. Patch factory-applied protective coating as recommended by manufacturer at field welds and where damage to coating occurs during construction.
- E. Flared Joints: Cut tubing with roll cutting tool. Flare tube end with tool to result in flare dimensions complying with SAE J513. Tighten finger tight, then use wrench. Do not overtighten.

3.5 HANGER AND SUPPORT INSTALLATION

- A. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices specified in Section 220548-Vibration and Seismic Controls for Plumbing Piping and Equipment.
- B. Comply with requirements for pipe hangers and supports specified in Section 220529-Hangers and Supports for Plumbing Piping and Equipment.
- C. Install hangers for horizontal steel piping with the following maximum spacing and minimum rod sizes:
 - 1. NPS 1 and Smaller: Maximum span, 96 inches; minimum rod size, 3/8 inch.
 - 2. NPS 1-1/4: Maximum span, 108 inches; minimum rod size, 3/8 inch.
 - 3. NPS 1-1/2 and NPS 2: Maximum span, 108 inches; minimum rod size, 3/8 inch.

3.6 CONNECTIONS

- A. Connect to utility's gas main according to utility's procedures and requirements.
- B. Install natural-gas piping electrically continuous and bonded to gas appliance equipment grounding conductor of the circuit powering the appliance according to NFPA 70.

- C. Install piping adjacent to appliances to allow service and maintenance of appliances.
- D. Connect piping to appliances using manual gas shutoff valves and unions. Install valve within 72 inches of each gas-fired appliance and equipment. Install union between valve and appliances or equipment.
- E. Sediment Traps: Install tee fitting with capped nipple in bottom to form drip, as close as practical to inlet of each appliance.

3.7 LABELING AND IDENTIFYING

- A. Comply with requirements in Section 220553-Identification for Plumbing Piping and Equipment for piping and valve identification.

3.8 FIELD QUALITY CONTROL

- A. Test, inspect, and purge natural gas according to NFPA 54 and authorities having jurisdiction.
- B. Natural-gas piping will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

3.9 OUTDOOR PIPING SCHEDULE

- A. Underground natural-gas piping shall be the following:
 - 1. PE pipe and fittings joined by heat fusion; service-line risers with tracer wire terminated in an accessible location.
- B. Aboveground natural-gas piping shall be one of the following:
 - 1. Steel pipe with malleable-iron fittings and threaded joints.
 - 2. Steel pipe with wrought-steel fittings and welded joints.

3.10 INDOOR PIPING SCHEDULE

- A. Aboveground, piping NPS 2-1/2" and smaller shall be one of the following:
 - 1. Steel pipe with malleable-iron fittings and threaded joints.
- B. Aboveground, piping NPS 3" and larger shall be one of the following:
 - 1. Steel pipe with wrought-steel fittings and welded joints.

3.11 ABOVEGROUND MANUAL GAS SHUTOFF VALVE SCHEDULE

- A. Valves for pipe sizes NPS 2 and smaller at service meter shall be one of the following:
 - 1. One-piece, bronze ball valve with bronze trim.
- B. Distribution piping valves for pipe sizes NPS 2 and smaller shall be one of the following:

July 11, 2018

POPE'S TAVERN
ADDITION/RENOVATION
Halifax, Massachusetts

1. One-piece, bronze ball valve with bronze trim.
- C. Valves in branch piping for single appliance shall be one of the following:
1. One-piece, bronze ball valve with bronze trim.

End of Section

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Section 22 11 23

DOMESTIC WATER PUMPS
(FILED SUB-BID REQUIRED AS PART OF SECTION 22 00 01)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Sub-Bid Requirements: As provided under Section 22 00 01 – Plumbing Filed Sub-Bid Requirements and supplemented under the Bidding Requirements, Contract Forms, and Conditions of the Contract, and applicable parts of Division 1 - General Requirements.
 - 1. Work of this Filed Sub-Bid includes all individual specification sections listed in Section 22 00 01.

1.2 SUMMARY

- A. Section Includes:
 - 1. In-line, sealless centrifugal pumps.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. LEED Submittals:
 - 1. Product Data for Prerequisite EA 2: Documentation indicating that units comply with applicable requirements in ASHRAE/IESNA 90.1, without amendments, Section 7 - "Service Water Heating."

1.4 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

1.5 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. UL Compliance: Comply with UL 778 for motor-operated water pumps.

PART 2 - PRODUCTS

2.1 IN-LINE, SEALLESS CENTRIFUGAL PUMPS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - 1. Armstrong Pumps Inc.

2. Bell & Gossett Domestic Pump; ITT Corporation.
 3. Grundfos Pumps Corp.
 4. TACO Incorporated.
 5. WILO USA LLC - WILO Canada Inc.
- C. Description: Factory-assembled and -tested, in-line, close-coupled, canned-motor, sealless, overhung-impeller centrifugal pumps.
- D. Pump Construction:
1. Pump and Motor Assembly: Hermetically sealed, replaceable-cartridge type with motor and impeller on common shaft and designed for installation with pump and motor shaft horizontal.
 2. Casing: Bronze, with threaded or companion-flange connections.
 3. Impeller: Plastic.
 4. Motor: Single speed, unless otherwise indicated.
- E. Capacities and Characteristics:
1. Capacity: Refer to pump schedule on drawings.
 2. Total Dynamic Head: Refer to pump schedule on drawings.
 3. Minimum Working Pressure: 125 psig.
 4. Maximum Continuous Operating Temperature: 220 deg F.
 5. Inlet and Outlet Size: Refer to pump schedule on drawings
 6. Pump Speed: Refer to pump schedule on drawings.
 7. Pump Control: Thermostat.
 8. Motor Horsepower: Refer to pump schedule on drawings.
 9. Electrical Characteristics:
 - a. Volts: 120.
 - b. Phases: Single.
 - c. Hertz: 60.
 - d. Full-Load Amperes: Refer to pump schedule on drawings.
 - e. Minimum Circuit Ampacity: Refer to pump schedule on drawings.
 - f. Maximum Overcurrent Protection: Refer to pump schedule on drawings.

2.2 MOTORS

- A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 220513 "Common Motor Requirements for Plumbing Equipment."
 - 1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.

2.3 CONTROLS

- A. Thermostats: Electric; adjustable for control of hot-water circulation pump.
 - 1. Type: Water-immersion temperature sensor, for installation in piping.
 - 2. Range: 50 to 125 deg F.
 - 3. Enclosure: NEMA 250, Type 4X.
 - 4. Operation of Pump: On or off.
 - 5. Transformer: Provide if required.
 - 6. Power Requirement: 120 V, ac.
 - 7. Settings: Start pump at 105 deg F and stop pump at 125 deg F.
- B. Timers: Electric, for control of hot-water circulation pump.
 - 1. Type: Programmable, seven-day clock with manual override on-off switch.
 - 2. Enclosure: NEMA 250, Type 1, suitable for wall mounting.
 - 3. Operation of Pump: On or off.
 - 4. Transformer: Provide if required.
 - 5. Power Requirement: 24-V ac.
 - 6. Programmable Sequence of Operation: Up to two on-off cycles each day for seven days.

PART 3 - EXECUTION

3.1 PUMP INSTALLATION

- A. Comply with HI 1.4.
- B. Install in-line, sealless centrifugal pumps with shaft horizontal unless otherwise indicated.
- C. Install horizontally mounted, in-line, close-coupled centrifugal pumps with shaft horizontal.
- D. Install continuous-thread hanger rods and spring hangers with vertical-limit stop of size required to support pump weight.

1. Comply with requirements for vibration isolation devices specified in Section 220548.13 "Vibration Controls for Plumbing Piping and Equipment." Fabricate brackets or supports as required.
 2. Comply with requirements for hangers and supports specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."
- E. Install thermostats in hot-water return piping.
- F. Install timers in mechanical room.

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. Install piping adjacent to pumps to allow service and maintenance.
- C. Connect domestic water piping to pumps. Install suction and discharge piping equal to or greater than size of pump nozzles.
1. Install flexible connectors adjacent to pumps in suction and discharge piping of the following pumps:
 - a. Horizontally mounted, in-line, close-coupled centrifugal pumps.
 - b. Comply with requirements for flexible connectors specified in Section 221116 "Domestic Water Piping."
 2. Install shutoff valve and strainer on suction side of each pump, and check, shutoff, and throttling valves on discharge side of each pump. Install valves same size as connected piping. Comply with requirements for valves specified in Section 220523 "General-Duty Valves for Plumbing Piping" and comply with requirements for strainers specified in Section 221119 "Domestic Water Piping Specialties."
 3. Install pressure gage and snubber at suction of each pump and pressure gage and snubber at discharge of each pump. Install at integral pressure-gage tappings where provided or install pressure-gage connectors in suction and discharge piping around pumps. Comply with requirements for pressure gages and snubbers specified in Section 220519 "Meters and Gages for Plumbing Piping."
- D. Connect thermostats and timers to pumps that they control.

3.3 ADJUSTING

- A. Adjust domestic water pumps to function smoothly, and lubricate as recommended by manufacturer.
- B. Adjust initial temperature set points.
- C. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

End of Section

Section 22 13 16

SANITARY WASTE AND VENT PIPING
(FILED SUB-BID REQUIRED AS PART OF SECTION 22 00 01)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Sub-Bid Requirements: As provided under Section 22 00 01 – Plumbing Filed Sub-Bid Requirements and supplemented under the Bidding Requirements, Contract Forms, and Conditions of the Contract, and applicable parts of Division 1 - General Requirements.
 - 1. Work of this Filed Sub-Bid includes all individual specification sections listed in Section 22 00 01.

1.2 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions, Division 0 and Division 1 Specifications Sections, apply to this section.

1.3 SUMMARY

- A. Section Includes:
 - 1. Pipe, tube, and fittings.
 - 2. Specialty pipe fittings.

1.4 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Soil, waste, and vent piping and support and installation shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1.5 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Seismic Qualification Certificates: For waste and vent piping, 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. Detailed description of piping anchorage devices on which the certification is based and their installation requirements.
- C. Field quality-control reports.

1.6 QUALITY ASSURANCE

- A. Provide in accordance with Section 01400 and as specified.
- B. Piping materials shall bear label, stamp, or other markings of specified testing agency.

- C. Provide in accordance with Section 01400 and as specified.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.2 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS

- A. Pipe and Fittings: ASTM A 888 or CISPI 301.
- B. Heavy-Duty, Hubless-Piping Couplings:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. ANACO-Husky.
 - b. Clamp-All Corp.
 - c. Dallas Specialty & Mfg. Co.
 - d. MIFAB, Inc.
 - e. Mission Rubber Company; a division of MCP Industries, Inc.
 - f. Stant.
 - g. Tyler Pipe.
 - 2. Standards: ASTM C 1277 and ASTM C 1540.
 - 3. Description: Stainless-steel shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

2.3 SPECIALTY PIPE FITTINGS

- A. Transition Couplings:
 - 1. General Requirements: Fitting or device for joining piping with small differences in OD's or of different materials. Include end connections same size as and compatible with pipes to be joined.
 - 2. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
 - 3. Shielded, Nonpressure Transition Couplings:
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) Cascade Waterworks Mfg. Co.

- 2) Mission Rubber Company; a division of MCP Industries, Inc.
- 3) Fernco, Inc.
- b. Standard: ASTM C 1460.
- c. Description: Elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.

PART 3 - EXECUTION

3.1 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 coordination drawings.
- B. Extend sanitary service piping outside of the building, as indicated on drawings, up to the inlet of the sewer grinder pump station.
 - 1. Coordinate sanitary service entry and connection to sewer grinder pump station with site contractor.
- 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 seismic restraints on piping. Comply with requirements for seismic-restraint devices specified in Section 220548-Vibration and Seismic Controls for Plumbing Piping and Equipment.
- J. 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 two 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.
- K. 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.

- L. 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.
 - 2. Horizontal Sanitary Drainage Piping: 2 percent downward in direction of flow.
- M. 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."
- N. Install aboveground copper tubing according to CDA's "Copper Tube Handbook."
- O. Plumbing Specialties:
 - 1. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers in sanitary drainage gravity-flow piping. Comply with requirements for cleanouts specified in Section 221319-Sanitary Waste Piping Specialties.
- P. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
- Q. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 220517-Sleeves and Sleeve Seals for Plumbing Piping.
- R. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 220517-Sleeves and Sleeve Seals for Plumbing Piping.
- S. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 220518-Escutcheons for Plumbing Piping.

3.2 JOINT CONSTRUCTION

- A. Join hubless, cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.
- B. Join copper tube and fittings with soldered joints according to ASTM B 828. Use ASTM B 813, water-flushable, lead-free flux and ASTM B 32, lead-free-alloy solder.
- C. Flanged Joints: Align bolt holes. Select appropriate gasket material, size, type, and thickness. Install gasket concentrically positioned. Use suitable lubricants on bolt threads. Torque bolts in cross pattern.

3.3 SPECIALTY PIPE FITTING INSTALLATION

- A. Transition Couplings:
 - 1. Install transition couplings at joints of piping with small differences in OD's.
 - 2. In Drainage Piping: Shielded, nonpressure transition couplings.

3.4 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements for seismic-restraint devices specified in Section 220548-Vibration and Seismic Controls for Plumbing Piping and Equipment.
- B. Comply with requirements for pipe hanger and support devices and installation specified in Section 220529-Hangers and Supports for Plumbing Piping and Equipment.
 - 1. Install carbon-steel pipe hangers for horizontal piping in noncorrosive environments.
 - 2. Install stainless-steel pipe hangers for horizontal piping in corrosive environments.
 - 3. Install carbon-steel pipe support clamps for vertical piping in noncorrosive environments.
 - 4. Install stainless-steel pipe support clamps for vertical piping in corrosive environments.
 - 5. Vertical Piping: MSS Type 8 or Type 42, clamps.
 - 6. Install individual, straight, horizontal piping runs:
 - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
 - 7. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
 - 8. Base of Vertical Piping: MSS Type 52, spring hangers.
- C. Support horizontal piping and tubing within 12 inches of each fitting and coupling.
- D. Support vertical piping and tubing at base and at each floor.
- E. Rod diameter may be reduced one 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: 60 inches with 3/8-inch rod.
 - 2. NPS 3: 60 inches with 1/2-inch rod.
 - 3. NPS 4 and NPS 5: 60 inches with 5/8-inch rod.
- G. Install supports for vertical cast-iron soil piping every 15 feet.
- H. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.5 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. Install test tees (wall cleanouts) in conductors near floor and floor cleanouts with cover flush with floor.
 5. Comply with requirements for cleanouts specified in Section 221319-Sanitary Waste Piping Specialties.
 6. 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 and larger.
- D. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.
- E. 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.

3.6 IDENTIFICATION

- A. Identify exposed sanitary waste and vent piping. Comply with requirements for identification specified in Section 220553-Identification for Plumbing Piping and Equipment.

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 AND PROTECTION

- 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.

3.9 PIPING SCHEDULE

- A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.
- B. Aboveground, soil and waste piping NPS 4 and smaller shall be the following:
 1. Heavy duty, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
 2. Hubless, cast-iron soil pipe and fittings; CISPI heavy-duty hubless-piping couplings; and coupled joints.
 3. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.
- C. Underground, soil, waste, and vent piping NPS 4 and smaller shall be the following:
 1. Heavy duty, cast-iron soil piping; and gasketed joints.
 2. Hubless, cast-iron soil pipe and fittings; CISPI heavy-duty cast-iron hubless-piping couplings; and coupled joints.

July 11, 2018

POPE'S TAVERN
ADDITION/RENOVATION
Halifax, Massachusetts

3. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.

3.10 CONTRACT CLOSEOUT

A. Provide in accordance with Section 01700 – Contract Closeout

End of Section

Section 22 13 19

SANITARY WASTE PIPING SPECIALTIES
(FILED SUB-BID REQUIRED AS PART OF SECTION 22 00 01)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Sub-Bid Requirements: As provided under Section 22 00 01 – Plumbing Filed Sub-Bid Requirements and supplemented under the Bidding Requirements, Contract Forms, and Conditions of the Contract, and applicable parts of Division 1 - General Requirements.
 - 1. Work of this Filed Sub-Bid includes all individual specification sections listed in Section 22 00 01.

1.2 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions, Division 0 and Division 1 Specifications Sections, apply to this section.

1.3 SUMMARY

- A. Section Includes:
 - 1. Cleanouts.
 - 2. Floor drains.
 - 3. Roof flashing assemblies.
 - 4. Miscellaneous sanitary drainage piping specialties.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and accessories for grease interceptors.

1.5 QUALITY ASSURANCE

- A. Provide in accordance with Section 01400 and as specified.
- B. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

PART 2 - PRODUCTS

2.1 CLEANOUTS

- A. Exposed Brass Cleanouts:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

- a. Josam Company.
 - b. MIFAB, Inc.
 - c. Smith, Jay R. Mfg. Co.
 - d. Tyler Pipe.
 - e. Watts Drainage Products.
 - f. Zurn Plumbing Products Group.
2. Standard: ASME A112.36.2M for brass for cleanout test tee.
 3. Size: Same as connected drainage piping.
 4. Body Material: Hubless, brass soil pipe test tee as required to match connected piping.
 5. Closure: Countersunk or raised-head, brass plug.
 6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
- B. Cast-Iron Floor Cleanouts:
1. Manufacturers: Subject to compliance with requirements, provide products by the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Josam Company; Josam Div.
 - b. Oatey.
 - c. Sioux Chief Manufacturing Company, Inc.
 - d. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - e. Tyler Pipe; Wade Div.
 - f. Watts Drainage Products Inc.
 - g. Zurn Plumbing Products Group; Light Commercial Operation.
 - h. Zurn Plumbing Products Group; Specification Drainage Operation.
 2. Standard: ASME A112.36.2M for adjustable housing cleanout.
 3. Size: Same as connected branch.
 4. Type: Adjustable housing.
 5. Body or Ferrule: Cast iron.
 6. Clamping Device: Required.
 7. Outlet Connection: Threaded.
 8. Closure: Cast-iron plug.

9. Adjustable Housing Material: Cast iron with threads.
10. Frame and Cover Material and Finish: Painted cast iron.
11. Frame and Cover Shape: Round.
12. Top Loading Classification: Heavy Duty.
13. Riser: ASTM A 74, Service class, cast-iron drainage pipe fitting and riser to cleanout.

C. Cast-Iron Wall Cleanouts:

1. Manufacturers: Subject to compliance with requirements, provide products by the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Josam Company; Josam Div.
 - b. MIFAB, Inc.
 - c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - d. Tyler Pipe; Wade Div.
 - e. Watts Drainage Products Inc.
 - f. Zurn Plumbing Products Group; Specification Drainage Operation.
2. Standard: ASME A112.36.2M. Include wall access.
3. Size: Same as connected drainage piping.
4. Body: Hubless, cast-iron soil pipe test tee as required to match connected piping.
5. Closure: Countersunk or raised-head, cast-iron plug.
6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
7. Wall Access: Round, flat, chrome-plated brass or stainless-steel cover plate with screw.
8. Wall Access: Square, nickel-bronze, copper-alloy, or stainless-steel wall-installation frame and cover.

2.2 FLOOR DRAINS

A. Cast-Iron Floor Drains:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. Commercial Enameling Co.
 - b. Josam Company; Josam Div.
 - c. MIFAB, Inc.
 - d. Prier Products, Inc.

- e. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - f. Tyler Pipe; Wade Div.
 - g. Watts Drainage Products Inc.
 - h. Zurn Plumbing Products Group; Light Commercial Operation.
 - i. Zurn Plumbing Products Group; Specification Drainage Operation.
- 2. Standard: ASME A112.6.3.
 - 3. Pattern: Floor drain.
 - 4. Body Material: Gray iron.
 - 5. Seepage Flange: Not required.
 - 6. Anchor Flange: Not required.
 - 7. Clamping Device: Not required.
 - 8. Outlet: Bottom.
 - 9. Backwater Valve: Not required.
 - 10. Coating on Interior and Exposed Exterior Surfaces: Not required.
 - 11. Sediment Bucket: Not required.
 - 12. Top or Strainer Material: Gray iron.
 - 13. Top of Body and Strainer Finish: Polished bronze.
 - 14. Top Shape: Round.
 - 15. Dimensions of Top or Strainer: 5"
 - 16. Top Loading Classification: Medium Duty.
 - 17. Funnel: Not required.
 - 18. Inlet Fitting: Gray iron, with threaded inlet and threaded or spigot outlet, and trap-seal primer valve connection.
 - 19. Trap Material: Cast iron.
 - 20. Trap Pattern: Standard P-trap.
 - 21. Trap Features: Cleanout and trap-seal primer valve drain connection.

2.3 ROOF FLASHING ASSEMBLIES

A. Roof Flashing Assemblies:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Acorn Engineering Company; Elmdor/Stoneman Div.
 - b. Thaler Metal Industries Ltd.
 - c. FlashCo.
2. Description: Manufactured assembly made of 4.0-lb/sq. ft., 0.0625-inch- thick, lead flashing collar and skirt extending at least 6 inches from pipe, with galvanized-steel boot reinforcement and counterflashing fitting.
 - a. Open-Top Vent Cap: Without cap.
 - b. Low-Silhouette Vent Cap: With vandal-proof vent cap.
 - c. Extended Vent Cap: With field-installed, vandal-proof vent cap.

2.4 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

A. 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 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.

2.5 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. Fasteners: Metal compatible with material and substrate being fastened.
- C. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.
- D. Solder: ASTM B 32, lead-free alloy.
- E. Bituminous Coating: SSPC-Paint 12, solvent-type, bituminous mastic.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:
 1. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.

2. Locate at each change in direction of piping greater than 45 degrees.
 3. Locate at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
 4. Locate at base of each vertical soil and waste stack.
- B. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.
- C. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.
- D. Install sleeve flashing device with each riser and stack passing through floors with waterproof membrane.

3.2 CONNECTIONS

- A. Comply with requirements in Section 221316 "Sanitary Waste and Vent Piping" for piping installation requirements. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment to allow service and maintenance.

3.3 FLASHING INSTALLATION

- A. Fabricate flashing from single piece unless large pans, sumps, or other drainage shapes are required. Join flashing according to the following if required:
1. Lead Sheets: Burn joints of lead sheets 6.0-lb/sq. ft., 0.0938-inch thickness or thicker. Solder joints of lead sheets 4.0-lb/sq. ft., 0.0625-inch thickness or thinner.
- B. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.
1. Pipe Flashing: Sleeve type, matching pipe size, with minimum length of 10 inches, and skirt or flange extending at least 8 inches around pipe.
 2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches around sleeve.
 3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches around specialty.
- C. Set flashing on floors and roofs in solid coating of bituminous cement.
- D. Secure flashing into sleeve and specialty clamping ring or device.

3.4 LABELING AND IDENTIFYING

- A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each grease interceptor.
- B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition

July 11, 2018

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to identifying unit. Nameplates and signs are specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.5 CONTRACT CLOSEOUT

A. Provide in accordance with Section 01700 – Contract Closeout

End of Section

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Section 22 36 00

INDIRECT DOMESTIC WATER HEATER
(FILED SUB-BID REQUIRED AS PART OF SECTION 22 00 01)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Sub-Bid Requirements: As provided under Section 22 00 01 – Plumbing Filed Sub-Bid Requirements and supplemented under the Bidding Requirements, Contract Forms, and Conditions of the Contract, and applicable parts of Division 1 - General Requirements.
 - 1. Work of this Filed Sub-Bid includes all individual specification sections listed in Section 22 00 01.

1.2 SUMMARY

- A. Section Includes:
 - 1. Indirect, domestic-water-in-coil, domestic water heater.
 - 2. Domestic-water heater accessories.

1.3 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Domestic-water heater shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 - 1. 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."

1.4 ACTION SUBMITTALS

- A. Product Data: For each type and size of domestic-water heater indicated.
- B. Shop Drawings:
 - 1. Wiring Diagrams: For power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

- A. Seismic Qualification Certificates: For domestic-water heater, accessories, and components, from manufacturer.
- B. Product certificates.
- 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.

July 11, 2018

1.6 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

1.7 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 90.1 Compliance: Applicable requirements in ASHRAE/IESNA 90.1.
- C. ASME Compliance: Where ASME-code construction is indicated, fabricate and label heat-exchanger 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, "Drinking Water System Components - Health Effects."

1.8 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of domestic-water heaters that fail in materials or workmanship within specified warranty period.
1. Warranty Periods: From date of Substantial Completion.
- a. Instantaneous, Indirect, Domestic-Water Heaters:
- 1) Water Heater: 10 years.
- 2) Controls and Other Components: Consult the terms of the manufacturer's warranty.

PART 2 - PRODUCTS

2.1 INDIRECT DOMESTIC-WATER HEATER

- A. Indirect Domestic-Water Heater:
1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on drawings or comparable product by one of the following:
- a. TFI Everhot.
- b. Ergomax.
2. Description: Packaged, large-capacity, hot-water storage tank with boiler water in storage tank and domestic hot water in coil; circulator; controls; and specialties for heating domestic water.
3. Construction: ASME Boiler and Pressure Vessel code, Section VIII, div.1, with a high-carbon steel tank.
- 4.
- a. High-carbon steel tank pressure rating: 150 psig.

- b. Insulation: Complying with ASHRAE/IESNA 90.1, unless otherwise indicated, and suitable for operating temperature. Surround entire tank with a glass fiber insulating jacket limiting thermal loss to ½°F per hour. The outer steel jacket shall be painted with baked epoxy.
 5. Heat-Exchanger Coils: Parallel helicoidal, copper coils for domestic water with a maximum operating pressure of 150 psi. All copper components and assembly shall meet the low lead requirements for potable plumbing products and shall adhere to the NSF 61 standard.
 6. Temperature Control: The water heater shall have a temperature controller (aquastat) that makes contact when the temperature falls below the tank's water temperature set point minus an adjustable differential (10°F to 40°F) and breaks contact when the temperature rises over the set point (95°F to 195°F).
 7. Safety Control: Automatic, high-temperature-limit cutoff device or system.
 8. Miscellaneous Components: Strainers, ¾" drain ball valve made of brass which has a maximum working pressure of 200psi, ASME rated pressure relief valve set at 50 psi protecting the tank, a 3-inch thermometer/pressure gage, automatic air vent, valves, and piping.
 9. Stand: Factory fabricated for floor mounting, three adjustable feet support the water heater for leveling.
- B. Capacity and Characteristics:
 1. Flow Rate: 15 gpm at 100 deg F temperature rise.
 2. Hot-Water Temperature Setting: 140 deg F.
 3. Domestic-Water Pipe Size: 2" NPS.
 4. Heating Hot-Water Supply:
 - a. Inlet Temperature: 160 deg F.
 - b. Outlet Temperature: 130 deg F.
 - c. Pipe Size: 2" NPS.

2.2 DOMESTIC WATER HEATER ACCESSORIES

- A. Domestic-Water Compression Tanks:
 1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on drawings or comparable product by one of the following:
 - a. Flexcon Industries.
 - b. Honeywell International Inc.
 - c. Pentair Pump Group (The); Myers.
 - d. Smith, A. O. Water Products Co.; a division of A. O. Smith Corporation.

- e. State Industries.
- f. Taco, Inc.
- 2. Description: Steel pressure-rated tank constructed with welded joints and factory-installed butyl-rubber diaphragm. Include air precharge to minimum system-operating pressure at tank.
- 3. Construction:
 - a. Tappings: Factory-fabricated steel, welded to tank before testing and labeling. Include ASME B1.20.1 pipe thread.
 - b. Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
 - c. Air-Charging Valve: Factory installed.
- 4. Capacity and Characteristics:
 - a. Working-Pressure Rating: 150 psig.
 - b. Capacity Acceptable: 14 gal. minimum.
 - c. Air Precharge Pressure: 55 psi.
- B. Piping-Type Heat Traps: Field-fabricated piping arrangement according to ASHRAE/IESNA 90.1 or ASHRAE 90.2.
- C. Heat-Trap Fittings: ASHRAE 90.2.
- D. 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 heat-exchanger working-pressure rating. Select relief valves with sensing element that extends into storage tank.
- E. Pressure Relief Valves: ASME rated and stamped. Include pressure setting less than heat-exchanger working-pressure rating.
- F. Vacuum Relief Valves: ANSI Z21.22/CSA 4.4-M.

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. 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 reinspecting 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. Domestic-Water, Heater Mounting: Install domestic-water heater by using the three adjustable feet provided on the unit to support the water heater for leveling.
- B. Install domestic-water heater 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 water heater and on domestic-hot-water outlet piping. Comply with requirements for shutoff valves specified in Section 220523 "General-Duty Valves for Plumbing Piping."
 - 2. Install shutoff valves on heating hot-water piping to water heater. Comply with requirements for shutoff valves specified in Section 230523 "General-Duty Valves for HVAC Piping."
- C. Install domestic-water heaters with seismic-restraint devices. Comply with requirements for seismic-restraint devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- D. Install temperature and pressure relief valves in top portion of indirect water heater tank. Use relief valves with sensing elements that extend into tanks. Extend 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.
- E. 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 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."
- F. Install thermometer on each domestic-water heater inlet and outlet piping, and install thermometer on each domestic-water heater heating-fluid inlet and outlet piping. Comply with requirements for thermometers specified in Section 220519 "Meters and Gages for Plumbing Piping."
- G. Install pressure gages on domestic-water heater, heating-fluid piping. Comply with requirements for pressure gages specified in Section 220519 "Meters and Gages for Plumbing Piping."
- H. Fill domestic-water heater with water.
- I. Charge domestic-water compression tanks with air.

3.2 CONNECTIONS

- A. Comply with requirements for piping specified in Section 221116 "Domestic Water Piping."
- B. Comply with requirements for heating hot-water piping specified in Section 232113 "Hydronic Piping" and Section 232116 "Hydronic Piping Specialties."
- C. Drawings indicate general arrangement of piping, fittings, and specialties.

- D. Where installing piping adjacent to 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. Domestic-water heaters will be considered defective if they do not pass tests and inspections. All domestic water heaters that are considered defective shall be replaced, re-installed, and retested until all pass inspection.
- 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 domestic water heater.

End of Section

Section 22 42 13.13

COMMERCIAL WATER CLOSETS
(FILED SUB-BID REQUIRED AS PART OF SECTION 22 00 01)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Sub-Bid Requirements: As provided under Section 22 00 01 – Plumbing Filed Sub-Bid Requirements and supplemented under the Bidding Requirements, Contract Forms, and Conditions of the Contract, and applicable parts of Division 1 - General Requirements.
 - 1. Work of this Filed Sub-Bid includes all individual specification sections listed in Section 22 00 01.

1.2 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions, Division 0 and Division 1 Specifications Sections, apply to this section.

1.3 SUMMARY

- A. Section Includes:
 - 1. Water closets.
 - 2. Flushometer valves.
 - 3. Toilet seats.

1.4 SUBMITTALS

- A. Product Data: For each type of product.
- B. Operation and Maintenance Data: For flushometer valves and electronic sensors to include in operation and maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Provide in accordance with Section 01400 and as specified.

PART 2 - PRODUCTS

2.1 WALL-MOUNTED WATER CLOSETS

- A. Water Closets: Wall mounted, top spud, accessible.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. American Standard America.
 - b. Briggs Plumbing Products, Inc.

- c. Capizzi.
 - d. Crane Plumbing, L.L.C.
 - e. Ferguson Enterprises, Inc.; ProFlo Brand.
 - f. Gerber Plumbing Fixtures LLC.
 - g. Kohler Co.
 - h. Mansfield Plumbing Products LLC.
 - i. Peerless Pottery Sales, Inc.
 - j. TOTO USA, INC.
 - k. Zurn Industries, LLC; Commercial Brass and Fixtures.
2. Bowl:
- a. Standards: ASME A112.19.2/CSA B45.1 and ASME A112.19.5.
 - b. Material: Vitreous china.
 - c. Type: Siphon jet.
 - d. Style: Flushometer valve.
 - e. Height: Standard.
 - f. Rim Contour: Elongated.
 - g. Water Consumption: 1.28 gal. per flush.
 - h. Spud Size and Location: NPS 1-1/2; top.
3. Flushometer Valve: Refer to Plumbing Fixture Schedule on plumbing drawings.
4. Toilet Seat: Refer to Plumbing Fixture Schedule on plumbing drawings.
5. Support:
- a. Standard: ASME A112.6.1M.
 - b. Description: Waste-fitting assembly, as required to match drainage piping material and arrangement with faceplates, couplings gaskets, and feet; bolts and hardware matching fixture.
 - c. Water-Closet Mounting Height: Handicapped/elderly according to ICC/ANSI A117.1.

2.2 FLUSHOMETER VALVES

- A. Automatic with Manual Courtesy Flush Button, Piston Flushometer Valves:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. Coyne & Delany Co.
 - b. Gerber Plumbing Fixtures LLC.
 - c. Sloan Valve Company.
 - d. Zurn Industries, LLC; Commercial Brass and Fixtures.
2. Standard: ASSE 1037.
3. Minimum Pressure Rating: 80 psig.
4. Features: Include integral check stop and backflow-prevention device.
5. Material: Brass body with corrosion-resistant components.
6. Exposed Flushometer-Valve Finish: Chrome plated.
7. Panel Finish: Chrome plated or stainless steel.
8. Style: Exposed.
9. Consumption: 1.28 gal. per flush.
10. Minimum Inlet: NPS 1.
11. Minimum Outlet: NPS 1-1/2.

2.3 TOILET SEATS

A. Toilet Seats:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. American Standard America.
 - b. Bemis Manufacturing Company.
 - c. Centoco Manufacturing Corporation.
 - d. Church Seats.
 - e. Jones Stephens Corp.; Comfort Seat Brand.
 - f. Kohler Co.
 - g. Olsonite Seat Co.
 - h. Sanderson Plumbing Products, Inc.
 - i. Sperzel of Lexington.

- j. TOTO USA, INC.
- k. Zurn Industries, LLC; Commercial Brass and Fixtures.
- 2. Standard: IAPMO/ANSI Z124.5.
- 3. Material: Plastic.
- 4. Type: Commercial (Standard).
- 5. Shape: Elongated rim, open front.
- 6. Hinge: Self-sustaining.
- 7. Hinge Material: Noncorroding metal.
- 8. Seat Cover: Required.
- 9. Color: White.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Water-Closet Installation:
 - 1. Install level and plumb according to roughing-in drawings.
 - 2. Install accessible, wall-mounted water closets at mounting height for handicapped/elderly, according to ICC/ANSI A117.1.
- B. Support Installation:
 - 1. Use carrier supports with waste-fitting assembly and seal.
 - 2. 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 automatic flushometer valves for accessible water closets with manual courtesy flush button mounted on open side of water closet.
 - 4. Install actuators in locations that are easy for people with disabilities to reach.
- 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 07920 "Joint Sealants."

3.2 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.

3.3 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.

3.4 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.

3.5 CONTRACT CLOSEOUT

- A. Provide in accordance with Section 01700 – Contract Closeout

End of Section

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Section 22 42 16.13

COMMERCIAL LAVATORIES
(FILED SUB-BID REQUIRED AS PART OF SECTION 22 00 01)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Sub-Bid Requirements: As provided under Section 22 00 01 – Plumbing Filed Sub-Bid Requirements and supplemented under the Bidding Requirements, Contract Forms, and Conditions of the Contract, and applicable parts of Division 1 - General Requirements.
 - 1. Work of this Filed Sub-Bid includes all individual specification sections listed in Section 22 00 01.

1.2 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions, Division 0 and Division 1 Specifications Sections, apply to this section.

1.3 SUMMARY

- A. Section Includes:
 - 1. Lavatories.
 - 2. Faucets.

1.4 SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Include diagrams for power, signal, and control wiring of automatic faucets.
- C. Coordination Drawings: Counter cutout templates for mounting of counter-mounted lavatories.
- D. Operation and Maintenance Data: For lavatories and faucets to include in operation and maintenance manuals.
 - 1. In addition to items specified in Section 01730 - Operation and Maintenance Data, include the following:
 - a. Servicing and adjustments of automatic faucets.

1.5 QUALITY ASSURANCE

- A. Provide in accordance with Section 01400 and as specified.

PART 2 - PRODUCTS

2.1 VITREOUS-CHINA, WALL-MOUNTED LAVATORIES

- A. Lavatory: Wheelchair, vitreous china, wall mounted.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. American Standard America.
 - b. Crane Plumbing, L.L.C.
 - c. Ferguson Enterprises, Inc.; ProFlo Brand.
 - d. Gerber Plumbing Fixtures LLC.
 - e. Kohler Co.
 - f. Mansfield Plumbing Products LLC.
 - g. Peerless Pottery Sales, Inc.
2. Fixture:
 - a. Standard: ASME A112.19.2/CSA B45.1.
 - b. Type: Slab or wheelchair.
 - c. Nominal Size: Rectangular, 20 by 18 inches.
 - d. Faucet-Hole Punching: One Hole.
 - e. Faucet-Hole Location: Top.
 - f. Soap-Hole Punching: One Hole.
 - g. Soap-Hole Location: Top.
 - h. Color: White.
 - i. Mounting: For concealed-arm carrier.
3. Faucet: Refer to Plumbing Fixture Schedule on plumbing drawings.
4. Support: ASME A112.6.1M, Type II, concealed-arm lavatory carrier with rectangular, steel uprights.

2.2 SOLID-BRASS, AUTOMATICALLY OPERATED FAUCETS

- A. NSF Standard: Comply with NSF/ANSI 61, "Drinking Water System Components - Health Effects," for faucet materials that will be in contact with potable water.
- B. Lavatory Faucets: Automatic-type, single-control mixing, solid-brass valve.
 1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. American Standard America.
 - b. Bradley Corporation.
 - c. Chicago Faucets.

- d. Delta Faucet Company.
 - e. Elkay Manufacturing Co.
 - f. Grohe America, Inc.
 - g. Just Manufacturing.
 - h. Kohler Co.
 - i. Moen Incorporated.
 - j. Speakman Company.
 - k. T & S Brass and Bronze Works, Inc.
 - l. Zurn Industries, LLC; Commercial Brass and Fixtures.
- 2. Standard: ASME A112.18.1/CSA B125.1.
 - 3. General: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture hole punchings; coordinate outlet with spout and fixture receptor.
 - 4. Body Type: Single hole.
 - 5. Body Material: Commercial, solid brass.
 - 6. Finish: Polished chrome plate.
 - 7. Maximum Flow Rate: 0.5 gpm.
 - 8. Maximum Flow: 0.25 gal. per metering cycle.
 - 9. Mounting Type: Deck, exposed.
 - 10. Valve Handle(s): Automatic.
 - 11. Spout: Rigid type.
 - 12. Spout Outlet: Aerator.
 - 13. Operation: Hand placement in front of sensor underneath faucet.
 - 14. Electrical: 120 VAC.

2.3 SUPPLY FITTINGS

- A. NSF Standard: Comply with NSF/ANSI 61, "Drinking Water System Components - Health Effects," for supply-fitting materials that will be in contact with potable water.
- B. Standard: ASME A112.18.1/CSA B125.1.
- C. Supply Piping: Chrome-plated-brass pipe or chrome-plated copper tube matching water-supply piping size. Include chrome-plated-brass or stainless-steel wall flange.
- D. Supply Stops: Chrome-plated-brass, one-quarter-turn, ball-type or compression valve with inlet connection matching supply piping.

- E. Operation: Wheel handle.
- F. Risers:
 - 1. NPS 3/8.
 - 2. Chrome-plated, soft-copper flexible tube riser.

2.4 WASTE FITTINGS

- A. Standard: ASME A112.18.2/CSA B125.2.
- B. Drain: Grid type with NPS 1-1/4 offset and straight tailpiece.
- C. Trap:
 - 1. Size: NPS 1-1/2 by NPS 1-1/4.
 - 2. Material: Chrome-plated, two-piece, cast-brass trap and swivel elbow with 0.032-inch-thick brass tube to wall; and chrome-plated, brass or steel wall flange.

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 lavatory installation.
- B. Examine counters and walls for suitable conditions where lavatories will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install lavatories level and plumb according to roughing-in drawings.
- B. Install supports, affixed to building substrate, for wall-mounted lavatories.
- C. Install accessible wall-mounted lavatories at handicapped/elderly mounting height for people with disabilities or the elderly, according to ICC/ANSI A117.1.
- D. 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."
- E. Seal joints between lavatories and counters 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."
- F. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible lavatories. Comply with requirements in Section 220719 "Plumbing Piping Insulation."

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."

3.4 ADJUSTING

- A. Operate and adjust lavatories and controls. Replace damaged and malfunctioning lavatories, fittings, and controls.
- B. Adjust water pressure at faucets to produce proper flow.
- C. Install fresh batteries in battery-powered, electronic-sensor mechanisms.

3.5 CLEANING AND PROTECTION

- A. After completing installation of lavatories, inspect and repair damaged finishes.
- B. Clean lavatories, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.
- C. Provide protective covering for installed lavatories and fittings.
- D. Do not allow use of lavatories for temporary facilities unless approved in writing by Owner.

3.6 CONTRACT CLOSEOUT

Provide in accordance with Section 01700 – Contract Closeout

End of Section

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Section 22 42 16.16

COMMERCIAL SINKS
(FILED SUB-BID REQUIRED AS PART OF SECTION 22 00 01)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Sub-Bid Requirements: As provided under Section 22 00 01 – Plumbing Filed Sub-Bid Requirements and supplemented under the Bidding Requirements, Contract Forms, and Conditions of the Contract, and applicable parts of Division 1 - General Requirements.
 - 1. Work of this Filed Sub-Bid includes all individual specification sections listed in Section 22 00 01.

1.2 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions, Division 0 and Division 1 Specifications Sections, apply to this section.

1.3 SUMMARY

- A. Section Includes:
 - 1. Janitors Sink.
 - 2. Analyzer Sink.
 - 3. General Purpose Sink.
 - 4. Sink faucets.
 - 5. Laminar-flow, faucet-spout outlets.
 - 6. Supply fittings.
 - 7. Waste fittings.

1.4 SUBMITTALS

- A. Product Data: For each type of product.
- B. Coordination Drawings: Counter cutout templates for mounting of counter-mounted lavatories.
- C. Maintenance data.

1.5 QUALITY ASSURANCE

- A. Provide in accordance with Section 01400 and as specified.

PART 2 - PRODUCTS

2.1 JANITORS SINK

A. Janitors Sink: Composite, floor mounted.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. Crane Plumbing, L.L.C.
 - b. Ferguson Enterprises, Inc.; ProFlo Brand.
 - c. Florestone Products Co., Inc.
 - d. Mustee, E. L., & Sons, Inc.
 - e. Swan Corporation (The).
 - f. Zurn Industries, LLC; Light Commercial Specialty Plumbing Products.
2. Fixture:
 - a. Standard: IAPMO/ANSI Z124.6.
 - b. Material: Composite.
 - c. Nominal Size: 24 by 24 by 10 inches.
 - d. Tiling Flange: On two sides.
 - e. Color: White.
 - f. Drain: Grid with NPS 3 outlet.
3. Mounting: On floor and flush to wall.
4. Faucet: Refer to Plumbing Fixture Schedule on plumbing drawings.

2.2 ANALYZER SINK

A. Analyzer Sink: Stainless steel, counter mounted.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. Advance Tabco.
 - b. Eagle Group; Foodservice Equipment Division.
 - c. Elkay Manufacturing Co.
 - d. Griffin Products, Inc.
 - e. Just Manufacturing.
2. Fixture:

- a. Standard: ASME A112.19.3/CSA B45.4.
 - b. Type: Ledge back.
 - c. Number of Compartments: Two.
 - d. Overall Dimensions: 25 by 19-1/2 by 10-1/8 inches.
 - e. Each Compartment:
 - 1) Dimensions: 10 by 14 by 10 inches.
 - 2) Drain: Grid with NPS 2 tailpiece and twist drain.
 - 3) Drain Location: Centered in compartment.
3. Faucet(s):
- a. Number Required: Refer to Plumbing Fixture Schedule on plumbing drawings.
 - b. Mounting: On ledge.
4. Supply Fittings:
- a. Standard: ASME A112.18.1/CSA B125.1.
 - b. Supplies: Chrome-plated brass compression stop with inlet connection matching water-supply piping type and size.
 - 1) Operation: Loose key.
 - 2) Risers: NPS 1/2, chrome-plated, soft-copper flexible tube.
5. Waste Fittings:
- a. Standard: ASME A112.18.2/CSA B125.2.
 - b. Trap(s):
 - 1) Size: NPS 2.
 - 2) Material: Chrome-plated, two-piece, cast-brass trap and ground-joint swivel elbow with 0.032-inch-thick brass tube to wall; and chrome-plated brass or steel wall flange.
 - c. Continuous Waste:
 - 1) Size: NPS 2.
 - 2) Material: Chrome-plated, 0.032-inch-thick brass tube.
6. Mounting: On counter with sealant.

2.3 GENERAL PURPOSE SINK

- A. General Purpose Sink: Stainless steel, top mounted.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. Advance Tabco.
 - b. AERO Manufacturing Company.
 - c. Amtekco Industries, Inc.
 - d. Eagle Group; Foodservice Equipment Division.
 - e. Elkay Manufacturing Co.
 - f. Griffin Products, Inc.
 - g. Just Manufacturing.
2. Fixture:
 - a. Standards: ASME A112.19.3/CSA B45.4 and NSF/ANSI 2.
 - b. Type: Basin with radius corners, back for faucet, and support brackets.
 - c. Nominal Size: 33 by 22 by 9 inches.
3. Faucet: Refer to Plumbing Fixture Schedule on plumbing drawings.
4. Supply Fittings: Comply with requirements in "Supply Fittings" Article.
5. Waste Fittings: Comply with requirements in "Waste Fittings" Article.
6. Support: ASME A112.6.1M, Type II, sink carrier.

2.4 SINK FAUCETS

- A. NSF Standard: Comply with NSF/ANSI 61, "Drinking Water System Components - Health Effects," for faucet-spout materials that will be in contact with potable water.
- B. Sink Faucets: Manual type, two-lever-handle mixing valve.
 1. Commercial, Solid-Brass Faucets:
 - a. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - 1) American Standard America.
 - 2) Bradley Corporation.
 - 3) Chicago Faucets.
 - 4) Delta Faucet Company.
 - 5) Elkay Manufacturing Co.
 - 6) GROHE America, Inc.

- 7) Just Manufacturing.
 - 8) Kohler Co.
 - 9) Moen Incorporated.
 - 10) Speakman Company.
 - 11) T & S Brass and Bronze Works, Inc.
 - 12) Zurn Plumbing Products Group.
2. Standard: ASME A112.18.1/CSA B125.1.
 3. General: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture hole punchings; coordinate outlet with spout and sink receptor.
 4. Body Type: Centerset.
 5. Body Material: Commercial, solid brass.
 6. Finish: Chrome plated.
 7. Maximum Flow Rate: 1.5 gpm.
 8. Handle(s): Cross, three arm.
 9. Mounting Type: Deck, exposed.
 10. Spout Type: Swivel gooseneck.
 11. Spout Outlet: Aerator.

2.5 SUPPLY FITTINGS

- A. NSF Standard: Comply with NSF/ANSI 61, "Drinking Water System Components - Health Effects," for supply-fitting materials that will be in contact with potable water.
- B. Standard: ASME A112.18.1/CSA B125.1.
- C. Supply Piping: Chrome-plated brass pipe or chrome-plated copper tube matching water-supply piping size. Include chrome-plated brass or stainless-steel wall flange.
- D. Supply Stops: Chrome-plated brass, one-quarter-turn, ball-type or compression valve with inlet connection matching supply piping.
- E. Operation: Loose key.
- F. Risers:
 1. NPS 3/8
 2. Chrome-plated, soft-copper flexible tube.

2.6 WASTE FITTINGS

- A. Standard: ASME A112.18.2/CSA B125.2.

- B. Drain: Grid type with NPS 1-1/2 offset and straight tailpiece.
- C. Trap:
 - 1. Size: NPS 1-1/2.
 - 2. Material: Chrome-plated, two-piece, cast-brass trap and ground-joint swivel elbow with 0.032-inch-thick brass tube to wall; and chrome-plated brass or steel wall flange.
 - 3. Material: Stainless-steel, two-piece trap and swivel elbow with 0.012-inch-thick stainless-steel tube to wall; and stainless-steel wall flange.

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 sink installation.
- B. Examine walls, floors, and counters for suitable conditions where sinks will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install sinks level and plumb according to roughing-in drawings.
- B. Install supports, affixed to building substrate, for wall-hung sinks.
- C. Install accessible wall-mounted sinks at handicapped/elderly mounting height according to ICC/ANSI A117.1.
- D. Set floor-mounted sinks in leveling bed of cement grout.
- E. Install water-supply piping with stop on each supply to each sink faucet.
 - 1. Exception: Use ball, gate, or globe valves if supply stops are not specified with sink. Comply with valve requirements specified in Section 220523 "General-Duty Valves for Plumbing Piping."
 - 2. Install stops in locations where they can be easily reached for operation.
- F. 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."
- G. Seal joints between sinks and 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."
- H. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible sinks. Comply with requirements in Section 220719 "Plumbing Piping Insulation."

3.3 CONNECTIONS

- A. Connect sinks 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."

3.4 ADJUSTING

- A. Operate and adjust sinks and controls. Replace damaged and malfunctioning sinks, fittings, and controls.
- B. Adjust water pressure at faucets to produce proper flow.

3.5 CLEANING AND PROTECTION

- A. After completing installation of sinks, inspect and repair damaged finishes.
- B. Clean sinks, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.
- C. Provide protective covering for installed sinks and fittings.
- D. Do not allow use of sinks for temporary facilities unless approved in writing by Owner.

3.6 CONTRACT CLOSEOUT

- A. Provide in accordance with Section 01700 – Contract Closeout

End of Section

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July 11, 2018

SECTION 230000

GENERAL CONDITIONS FOR HVAC WORK
(FILED SUB-BID REQUIRED AS PART OF SECTION 23 00 01)

PART 1 – GENERAL

1.1 GENERAL PROVISIONS

- A. Sub-Bid Requirements: As provided under Section 23 00 01 – Heating, Ventilating and Air Conditioning Filed Sub-Bid Requirements and supplemented under the Bidding Requirements, Contract Forms, and Conditions of the Contract, and applicable parts of Division 1 - General Requirements.
 - 1. Work of this Filed Sub-Bid includes all individual specification sections listed in Section 23 00 01.
- B. Work for this project will be performed in an occupied building. Systems including but not limited to: Heating and cooling will have to remain operational in season for areas outside of the construction zone. All shutdowns require 48hrs advanced notice to The Town of Halifax. Contractor shall provide continuous temporary domestic hot water heating during boiler replacement. If work is performed between September 1st and June 1st; then provisions must be made for temporary boiler (heating hot water) IN ADDITION TO temporary domestic hot water heating.
- C. Deactivate, disconnect, drain, and make safe selected HVAC equipment and distribution. Cut free and lower to the floor for removal by HVAC contractor.
- D. Provide Labor, materials and equipment necessary to complete the work of this section, including but not limited to the following:
 - 2. Survey of existing conditions prior to demolition.
 - 3. Deactivation, demolition and removal in phase of all existing equipment, piping, ductwork and associated appurtenances as depicted in the demolition drawings for each building. Deactivate, make safe, drain, and cut piping, ductwork, equipment and related materials. Disposal by HVAC contractor.
 - 4. Maintain existing systems in operation as required by the Town of Halifax. Phasing by contractor shall include any temporary services.
 - 5. Provide for temporary heating or cooling if those systems must be shut down during their operating season as dictated by the Town of Halifax.
 - 6. Instruction manuals, training of maintenance staff and Startup instructions.
 - 7. Testing and Balancing.
 - 8. Cleaning of surfaces and equipment new and old related to HVAC work.

July 11, 2018

9. Coordination drawings, record drawings, and similar requirements.
- E. Contractor shall provide all materials and equipment necessary for the Installation of the following materials and equipment:
- a. Sleeves, Inserts, and Hangers.
 - b. Flexible connections for pumps and other vibrating and rotating equipment.
 - c. Equipment bases and supports interior of the building.
 - d. Vibration isolators.
 - e. Motors.
 - f. Pressure gauges and Thermometers.
 - g. Sheet metal work.
 - h. Insulation for ductwork, piping, equipment, and tanks.
 - i. Pipe, Duct, Valve and equipment identification.
 - j. Temperature Controls (Thermostats etc.)
 - k. Condensing boiler
 - l. Air duct accessories
 - m. Hydronic Pumps
 - n. Hydronic piping
 - o. Hydronic Specialties
 - p. Condensing units
 - q. Air Handlers
 - r. Kitchen exhaust hood & Fan
 - s. Hot Gas bypass System
 - t. Refrigerant system
- F. Perform work and provide material and equipment as shown on drawings and as specified or indicated in this section of the specifications. Completely coordinate work of this section with work of other trades and provide a complete and fully functional installation.
- G. Give notices, file plans, obtain permits and licenses, pay fees and back charges, and obtain necessary approvals from authorities that have jurisdiction as required to perform work in accordance with all legal requirements and with specifications, drawings, addenda, and change orders; all of which are part of the Contract Documents.

1.2 SUBMITTALS

- A. Comply with requirements in General Notes located on drawing M-0
- B. Material and equipment requiring shop drawing submittals shall include but not limited to:
 1. Hydronic piping.
 2. Hydronic pumps.
 3. Fittings, Valves, and Strainers.
 4. Expansion Tanks and water system special fittings.

July 11, 2018

5. Automatic Controls.
6. Insulation.
7. Condensing Boilers.
8. Vibration Isolators.
9. Pressure Gauges and Thermometers.
10. Pipe, Pipe Hangers, Sleeves, and inserts.
11. Equipment bases and Supports.
12. Identification for pipe, duct, valves and equipment.
13. Motors.
14. Registers, Grilles, And Diffusers.
15. Breeching for Boilers
16. Escutcheons for HVAC piping
17. Meters and gages
18. Vibration controls
19. Balancing reports
20. Installation, Operation, and Maintenance manual & related materials.

1.3 REFERENCES

- A. Except where modified by a specific notation to the contrary, it shall be understood that the indication and/or description of any item in the drawings or specifications for electrical work carries with it the instruction to furnish, install and connect the item as part of the HVAC work, regardless of whether or not this instruction is explicitly stated.
- B. It shall be understood that the specifications and drawings for HVAC work are complimentary and are to be taken together for a complete interpretation of the HVAC work except that indications on the drawings, which refer to and individual element of work, take precedence over the specifications where they conflict with the same.

1.4 REGULATORY REQUIREMENTS

- A. Comply with all applicable federal and state laws, and all local codes, by-laws and ordinances.
- B. Where provisions of the contract documents conflict with any codes, rules or regulations, the latter shall govern. Where the contract requirements are in excess of applicable codes, rules, or regulations, the contract provisions shall govern unless the engineer rules otherwise.
- C. Request inspections from the authorities having jurisdiction, obtain all permits and pay for all fees and inspection certificates as applicable and/or required. All permits and certificates shall be turned over to the owner's representative at the completion of the work. Copies of permits shall be given to the resident engineer prior to the start of work.
- D. Unless otherwise specified or Indicated, materials, workmanship, and equipment performance shall conform with the latest edition of the following standards, codes, specifications, requirements, and regulations:
 1. State building Code
 2. State Mechanical Code

July 11, 2018

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3. State Energy Conservation Code
 4. National Fire Protection Association (NFPA)
 5. Local Town Regulations and By-Laws
 6. Underwriters Laboratories Inc (UL)
 7. National Electrical Manufacturers Association (NEMA)
 8. American National Standards Institute (ANSI)
 9. The American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE).
- E. All HVAC work shall meet or exceed any other state or local codes and/or authorities having jurisdiction including all other standards indicated herein.

1.5 SURVEYS AND MEASUREMENTS

- A. Base all required measurements, both horizontal and vertical, on reference points established by the contractor and be responsible for the correct layout of HVAC work. In the event of a discrepancy between actual measurements and those indicated, notify the Engineer in writing, and do not proceed with the work required until written instructions have been issued by the Engineer.

1.6 COORDINATION

- A. Drawings are diagrammatic. They indicate general arrangements of mechanical and electrical systems and other work. They do not show all offsets required for coordination nor do they show the exact routings and locations needed to coordinate with structure and other trades to meet architectural requirements.
- B. Work shall be performed in cooperation with other trades on the project and so scheduled to allow speedy and efficient completion of the work.
- C. Furnish to other trades advance information on locations and sizes of all frames, sleeves and openings needed for their work, and furnish information and shop drawings necessary to permit trades effected by the work to install same properly and without delay.
- D. If any HVAC work has been installed before coordination with other trades so as to cause interference with the work of such trades, all necessary adjustments and corrections shall be made by the HVAC trades involved without extra cost to the owner.
- E. Where conflicts or potential conflicts exist, and engineering guidance is desired, submit a sketch of proposed resolution to the Engineer for review.
- F. Protect all materials and work of other trades from damage which may be caused by the HVAC work, and repair all damages without extra cost to the owner.

1.7 MECHANICAL AND ELECTRICAL COORDINATION

July 11, 2018

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- A. Heating and Ventilation contractor shall furnish and install various electrical items relating to the heating and ventilation equipment and control apparatus. The electrical contractor shall be required to connect power wiring to this equipment unless otherwise noted.
 - B. The heating and Ventilation and Electrical Contractors shall have coordinated their respective portions of the work, as well as the electrical characteristics of the heating and ventilating equipment
 - C. All power wiring and local disconnect switches will be provided by the electrical contractor for the line voltage power. All control and interlocking wiring shall be the responsibility of the heating and Ventilation Contractor.
 - D. 120V and above power wiring sources extended and connected to heating and ventilation control panels, transformers, and switches shall be the responsibility of the electrical Contractor. All low voltage thermostats, zone valves, and any switch wiring shall be the responsibility of the Heating and Ventilation Contractor.
 - E. Temperature control and equipment wiring shall be installed by the Heating and Ventilating Contractor.

1.8 INSTALLATION REQUIREMENTS

- A. The Arrangement of all work shown on the drawings is diagrammatic only and indicates the minimum requirements for the work. Conditions at the building including actual measurements shall determine the details of the installation. All work shall be laid out and installed so as to require the least amount of cutting and patching.
- B. Check the Architectural plans and specifications (if any) before ordering any material and equipment. Any discrepancies shall be brought to the attention of the Engineer for their determination prior to proceeding with the work.

1.9 TYPICAL DETAILS

- A. Typical details where shown on the drawings shall apply to each and every item of the project where such items are applicable. They are not repeated in full on the drawings, which in many cases are diagrammatic only. But with the intention that such details shall be incorporated in full. Any alternate method proposed for use by the contractor shall have the prior approval of the Engineer.

1.10 CORING, DRILLING

- A. Core, cut and/or drill all small holes 4.5" diameter or less in walls and floors required for the installation of sleeves and supports for HVAC work.

1.11 SUPPLEMENTARY SUPPORTING STEEL

July 11, 2018

- A. Provide all supplementary steel work required for mounting or supporting equipment and materials.
- B. Steel work shall be firmly connected to the building construction as required.
- C. Steel work shall be of sufficient strength to allow only minimum deflection in conformity with manufacturers published requirements
- D. All supplementary steel work shall be installed in a neat and workmanlike manner parallel to the floor, wall and ceiling construction. All turns shall be made at forty-five and ninety degrees, and/or as dictated by construction and installation conditions.
- E. All manufactured steel parts and fittings shall be galvanized.

1.12 TOOLS AND EQUIPMENT

- A. Provide all tools and equipment required for the fabrication and installation of the mechanical and electrical equipment at the site.

1.13 PORTABLE AND DETATCHABLE PARTS

- A. Contractors shall retain in their possession all portable and/or detachable parts and portions of materials, devices, equipment etc. necessary for the proper operation and maintenances of the mechanical and electrical systems until final completion of the work, at which time they shall be handed over to the Owner's representative.

1.14 RECORD DRAWINGS, PROJECT CLOSEOUT

- A. Comply with requirements specified in DIVISION 01
- B. Drawings shall show record condition of details, sections, riser diagrams, control changes and corrections to schedules. Schedules shall show actual manufacturer make and model numbers of final equipment installation.

1.15 GUARANTEE/WARRANTY

- A. Guarantee work of this section in writing for one year following the date of beneficial occupancy by the user agency. The Guarantee shall repair or replace defective materials, equipment, workmanship and installation that develop within this period, promptly and to engineer's satisfaction and correct damaged cause in making necessary repairs and replacements under guarantee within contract price.

July 11, 2018

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- B. In addition to guarantee requirements of Division 01 and subparagraph "A" above, obtain written equipment and material warranties offered in manufacturers published data without exclusion or limitation, in User Agency's name.
 - C. Upon receipt of notice from Owner's representative of failure of any part of the systems or equipment during the warranty period, the affected part or parts shall be replaced by this contractor without any reimbursement.
 - D. Replace material and equipment that require excessive service during guarantee period as defined and as directed by Engineer.
 - E. Provide 24-hour service beginning on the date the project is accepted by Owner, whether or not fully occupied, and lasting until the termination of the guarantee period. Service shall be at no cost to the owner. Service can be provided by this contractor or a separate service organization. Choice of service organization shall be subject to engineer and Owner's representative's approval. Submit name and phone number that will be answered on a 24-hour basis each day of the week, for the duration of the service.
 - F. Submit copies of equipment and material warranties to Engineer before final payment.
 - G. At the end of guarantee period, transfer manufacturer's equipment and material warranties still in force to the User Agency.
 - H. This paragraph shall not be interpreted to limit the Owner's right under applicable codes and laws under this contract.
 - I. The other sections of this specification may specify warranty requirements that exceed those of this paragraph. Those paragraphs will govern.
 - J. Use of systems provided under this section for temporary services and facilities shall not constitute final acceptance of work by Owner's Representative and shall not initiate the guarantee period.
 - K. Provide manufacturer's engineering and technical staff at site to analyze and rectify problems that develop during guarantee period immediately. If problems cannot be rectified immediately to the Owner's Representative's satisfaction, advise the engineer in writing. Describe efforts to rectify the situation and provide analysis of the problem. Engineer will direct a course of action.

1.16 OPERATING, INSTRUCTION AND MAINTANANCE MANUALS

- A. Refer to Division 23 for submittal procedures pertaining to operating and maintenances manuals.
- B. Each copy of the approved operating and maintenance manual shall contain copies of approved shop drawings, equipment literature, cuts, bulletins, details, equipment and engineering data

July 11, 2018

sheets and type written instructions relative to the care and maintenance for the operation of the equipment, all properly indexed. Each Manual shall have the following minimum table of contents:

1. Introduction:
 - a. Explanation of manual and its purpose and use.
 - b. Description of the HVAC systems
 - c. Safety precautions and necessary for equipment
 - d. Illustrations, Schematics and diagrams.
 - e. Installation drawing.
2. Maintenance:
 - a. Maintenances and Lubrication instructions
 - b. Replacement charts
 - c. Trouble shooting charts for equipment components.
 - d. Testing instructions for each typical component.
 - e. Two typed sets of instructions for ordering spare parts. Each set shall include name, price, telephone number and address of where they may be obtained.
3. Manufacturer's Literature for the equipment for which shop drawings have been submitted and approved.

1.17 QUALITY ASSURANCE

- A. The requirements of the State Building Code and local regulations establish the minimum acceptable quality of workmanship and materials, and all work shall conform thereto unless more stringent requirements are indicated or specified herein.
- B. All work shall comply with the latest editions of the codes referenced herein.
- C. Follow manufacturer's directions for articles furnished, in addition to directions shown on drawings or specified herein.
- D. Protect all work, materials, and equipment from damage during process of work. Replace all damaged or defective work, materials and equipment without additional cost to owner.
- E. All equipment and materials for permanent installation shall be the products of recognized manufacturers and shall be new.
- F. Equipment and materials shall:
 1. Where normally subject to Underwriters Laboratory Inc listing or labeling services, be so listed or labeled.
 2. Be without blemish or defect.
 3. Not be used for temporary purposes.
 4. Be in accordance with the latest applicable NEMA standards.

July 11, 2018

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5. Be products which will meet with the acceptance of all authorities having jurisdiction over the work. Where such acceptance is contingent upon having the products examined, tested and certified by Underwriters or other recognized testing laboratory, the product shall be so examined, tested and certified.
- G. For items which are to be installed but not purchased as part of the HVAC work, the work shall include:
1. The coordination of their delivery.
 2. Their unloading from delivery trucks driven into any point on the property line at grade level.
 3. Their safe handling and field storage up to the time of permanent placement in the project.
 4. The correction of any damage, defacement, or corrosion to which they may have been subjected. Replacement if necessary shall be coordinated with contractor who originally purchased the item.
 5. Their field make-up and internal wiring as may be necessary for their proper operation.
 6. Their mounting in place including the purchase and installation of all dunnage, supporting members, and fastening necessary to adapt them to architectural and structural conditions.

1.18 DELIVERY, STORAGE AND HANDLING

- A. All materials for the work of this section shall be delivered, stored and handled as to preclude damage of any nature. Manufacture red materials shall be delivered and stored in their original containers, plainly marked with the products manufacturer's name. Materials in broken containers or in packages showing watermarks or other evidence of damage shall not be used and be removed from the site.

PART 2 – PRODUCTS

2.1 Manufacturers

- A. Product specifications are written in such a manner so as to specify what materials may be used in a particular location or application and therefore do not indicate what is not acceptable or suitable for a particular location or application. As an example: non-metallic sheathed cable is not specified; therefore, it is not acceptable.
- B. For the purpose of establishing a standard of quality and not for purpose of limiting completion, the basis of this specification is upon specified models and types of equipment and materials, as manufacture red by specified manufacturers.
- C. In all cases, standard cataloged materials and systems have been selected. In the case of systems, the system components shall be from a single source regularly engaged in supplying such systems. A proposed system made up of a collection of various manufacturers products will be unacceptable.

July 11, 2018

- D. Where specifications list manufacturer's names and/or "as approved" or "Equal approved by engineer", other manufacturers equipment will be considered if equipment meets specification requirements and has all features of the specified items as are considered essential by the Engineer.
- E. All materials shall be new, and UL listed.
- F. Provide products by specified manufacturers or approved equal.

PART 3 – EXECUTION

3.1 Not Applicable.

END OF SECTION

Section 23 00 01

HEATING, VENTILATING AND AIR CONDITIONING FILED SUB-BID REQUIREMENTS
(FILED SUB-BID REQUIRED)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. The BIDDING REQUIREMENTS, CONTRACT FORMS, and CONTRACT CONDITIONS as listed in the Table of Contents, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Work of this Section requires Filed Sub-Bids and is governed by the provisions of the Massachusetts General Laws (MGL), Public Bidding Law - Chapter 149, Sections 44A to 44J inclusive, as amended, and applicable Sections of the MGL, Public Contract Law - Chapter 30.
- C. Specification requirements for the Filed Sub-Bid "HEATING, VENTILATING AND AIR CONDITIONING" includes all work of the following listed Specification Sections, in their entirety:
 - 1. Section 23 00 01 – Heating, Ventilating and Air Conditioning Filed Sub-Bid Requirements
 - 2. Section 23 00 00 – General Conditions for HVAC Work.
 - 3. Section 23 05 13 – Common Motor Requirements for HVAC Equipment
 - 4. Section 23 05 16 – Expansion Fittings and Loops for HVAC Piping
 - 5. Section 23 05 17 – Sleeves and Sleeve Seals for HVAC Piping
 - 6. Section 23 05 18 – Escutcheons for HVAC Piping
 - 7. Section 23 05 19 – Meters and Gages for HVAC Piping
 - 8. Section 23 05 23.12 – Ball Valves for HVAC Piping
 - 9. Section 23 05 23.14 – Check Valves for HVAC Piping
 - 10. Section 23 05 29 – Hangers and Supports for HVAC Piping and Equipment
 - 11. Section 23 05 48 – Vibration and Seismic Controls for HVAC
 - 12. Section 23 05 53 – Identification for HVAC Piping and Equipment
 - 13. Section 23 05 93 – Testing, Adjusting and Balancing for HVAC
 - 14. Section 23 07 16 – HVAC Equipment Insulation
 - 15. Section 23 07 19 – HVAC Piping Insulation
 - 16. Section 23 21 13 – Hydronic Piping
 - 17. Section 23 21 16 – Hydronic Piping Specialties
 - 18. Section 23 21 23 – Hydronic Pumps
 - 19. Section 23 23 00 – Refrigerant Piping
 - 20. Section 23 33 00 – Air Duct Accessories
 - 21. Section 23 35 33 - Listed Kitchen Ventilation System Exhaust Ducts
 - 22. Section 23 38 13 - Commercial Kitchen Hoods
 - 23. Section 23 52 16 – Condensing Boilers

- 24. Section 23 62 00 – Packaged Compressor and Condenser Units
- 25. Section 23 73 13.13 – Indoor Basic Air Handling Units

D. The work to be completed by the Filed Subcontractor for the work of this Section is shown on the following listed Drawings, not just those pertaining particularly to this Sub-Trade, unless specifically called out otherwise, regardless of where among the Drawings it appears:

- G-001 TITLE SHEET
- G-002 CODE SUMMARY, NOTES & DRAWING LIST
- AD-101 EXISTING & SELECTIVE REMOVAL PLANS
- A-100 BASEMENT PLAN
- A-101 FIRST FLOOR PLAN
- A-102 SECOND FLOOR PLAN
- A-104 REFLECTIVE CEILING PLANS
- H-001 HVAC LEGENDS, NOTES & ABBREVIATIONS
- H-002 HVAC SCHEDULES
- H-003 HVAC DETAILS
- H-004 HVAC BOILER PIPING SCHEMATIC
- H-005 HVAC AIR HANDLING UNIT SCHEMATIC
- H-100 HVAC BASEMENT DEMOLITION PLAN
- H-101 HVAC FIRST FLOOR DEMOLITION PLAN
- H-102 HVAC SECOND FLOOR DEMOLITION PLAN
- H-200 HVAC BASEMENT NEW WORK PLAN
- H-201 HVAC FIRST FLOOR NEW WORK PLAN
- H-202 HVAC SECOND FLOOR NEW WORK PLAN

- E. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the Work of this Filed Subcontract.
- F. Filed Sub-Bids for work under this Section shall be for the complete work and shall be submitted electronically to the Awarding Authority at time, and in manner stipulated in the INVITATION TO BID and INSTRUCTIONS TO BIDDERS.
 - 1. Each Sub-Bid submittal for work under this Section shall be accompanied with the required bid deposit.
- G. Sub Sub-Bid Requirements: In accordance with Massachusetts General Law, Chapter 149, Section 44F, as amended, The Filed Sub-Bidder shall list in Paragraph E of the "Form for Sub-Bids" the name and bid price of each person, firm or corporation performing each class of work or part thereof for which the Section of the Specifications for that Sub-Trade require such listing.
 - 1. This filed trade requires that the following classes of work be listed in paragraph E under the conditions indicated herein.

Class Of Work	Reference Section
a. Ductwork	Sections 23 33 00, 23 35 33 and 23 38 13
b. Insulation	Section 23 07 16, 23 07 19
c. testing and balancing	Section 23 05 93

July 11, 2018

1.2 EXAMINATION OF SITE AND DOCUMENTS

- A. 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 (Owner) will not be responsible for errors, omissions and/or charges for extra work arising from General Contractor's or Filed Subcontractor's failure to familiarize themselves with the Contract Documents or existing 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: Bidders are strongly encouraged to attend the Pre-Bid conference; refer to INVITATION TO BID for time and date.

1.3 SEQUENCING

- A. Coordinate work of this Filed Subcontract with that of other trades, affecting or affected by this work, and cooperate with the other trades as is necessary to assure the steady progress of work.
- B. Do not order or deliver any materials until all schedules and submittals, required in the listed Specification Sections included as part of this Filed Subcontract, have been received and approved by the Architect.
- C. Before proceeding with installation work, inspect all project conditions and all work of other trades to assure that all such conditions and work are suitable to satisfactorily receive the work of this Section and notify the Architect in writing of any which are not. Do not proceed further until corrective work has been completed or waived.

PART 2 - PRODUCTS

2.1 SCAFFOLDS AND STAGING

- A. General: Filed Subcontractors shall obtain required permits for, and provide scaffolds, staging, and other similar raised platforms, required to access their Work as specified in Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS and herein.
 - 1. Scaffolding and staging required for use by this Filed Subcontractor pursuant to requirements of Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS shall be furnished, erected, maintained in a safe condition, and dismantled when no longer required, by this Filed Sub-Trade requiring such scaffolding.
 - 2. Each Filed Subcontractor is responsible to provide, maintain and remove at dismantling, all tarpaulins and similar protective measures necessary to cover scaffolding for inclement weather conditions other than those required to be provided, maintained and removed by the General Contractor pursuant to MGL (Refer to Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS and as additionally required for dust control).
 - 3. Furnishing portable ladders and mobile platforms of all required heights, which may be necessary to perform the work of this trade, are the responsibility this Filed Subcontractor.

July 11, 2018

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2.2 HOISTING MACHINERY AND EQUIPMENT

- A. All hoisting equipment, rigging equipment, crane services and lift machinery required for the work by this Filed Subcontractor shall be furnished, installed, operated and maintained in safe conditions by this Filed Subcontractor, as referenced under Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS.

PART 3 - EXECUTION (Not Used)

End of Section

SECTION 230513

COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT
(FILED SUB-BID REQUIRED AS PART OF SECTION 23 00 01)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Sub-Bid Requirements: As provided under Section 23 00 01 – Heating, Ventilating and Air Conditioning Filed Sub-Bid Requirements and supplemented under the Bidding Requirements, Contract Forms, and Conditions of the Contract, and applicable parts of Division 1 - General Requirements.
 - 1. Work of this Filed Sub-Bid includes all individual specification sections listed in Section 23 00 01.

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 alternating-current power systems up to 600 V 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 NEMA MG 1 unless otherwise indicated.

2.2 MOTOR CHARACTERISTICS

- A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet above sea level.

July 11, 2018

- 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: Premium 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. Rotor: Random-wound, squirrel cage.
- F. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.
- G. Temperature Rise: Match insulation rating.
- H. Insulation: Class F.
- I. Code Letter Designation:
 - 1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
 - 2. Motors Smaller Than 15 HP: Manufacturer's standard starting characteristic.
- J. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

2.4 ADDITIONAL REQUIREMENTS FOR POLYPHASE MOTORS

- 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. 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

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SECTION 230516

EXPANSION FITTINGS AND LOOPS FOR HVAC PIPING
(FILED SUB-BID REQUIRED AS PART OF SECTION 23 00 01)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Sub-Bid Requirements: As provided under Section 23 00 01 – Heating, Ventilating and Air Conditioning Filed Sub-Bid Requirements and supplemented under the Bidding Requirements, Contract Forms, and Conditions of the Contract, and applicable parts of Division 1 - General Requirements.
 - 1. Work of this Filed Sub-Bid includes all individual specification sections listed in Section 23 00 01.

1.2 SUMMARY

- A. Section Includes:
 - 1. Slip-joint, packed expansion joints.
 - 2. Metal, compensator packless expansion joints.
 - 3. Rubber union connector packless expansion joints.
 - 4. Flexible-hose packless expansion joints.
 - 5. Externally pressurized metal-bellows packless expansion joints.
 - 6. Alignment guides and anchors.
 - 7. Pipe loops and swing connections.

1.3 SUBMITTALS

- A. Product Data: For each type of product.
- B. Delegated-Design Submittal: For each anchor and alignment guide, including analysis data, signed and sealed by the qualified professional engineer responsible for their preparation.
 - 1. Design Calculations: Calculate requirements for thermal expansion of piping systems and for selecting and designing expansion joints, loops, and swing connections.
 - 2. Anchor Details: Detail fabrication of each anchor indicated. Show dimensions and methods of assembly and attachment to building structure.
 - 3. Alignment Guide Details: Detail field assembly and attachment to building structure.
 - 4. Schedule: Indicate type, manufacturer's number, size, material, pressure rating, end connections, and location for each expansion joint.
- C. Welding certificates.
- D. Maintenance data.

1.4 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Pipe and Pressure-Vessel Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Compatibility: Products shall be suitable for piping service fluids, materials, working pressures, and temperatures.
- B. Capability: Products to absorb 200 percent of maximum axial movement between anchors.

2.2 PACKED EXPANSION JOINTS

- A. Slip-Joint Packed Expansion Joints:
 - 1. Standard: ASTM F 1007.
 - 2. Material: Carbon steel with asbestos-free PTFE packing.
 - 3. Design: With internal guide and injection ports for repacking under full system pressure. Housing shall be furnished with drain ports and lifting ring. Include drip connection if used for steam piping.
 - 4. Configuration: Single joint class(es), unless otherwise indicated.
 - 5. Slip Tube for sizes NPS 1-1/2 through NPS 16: Schedule 80.
 - 6. Sliding Surface: 2 mil thick chrome finish.
 - 7. End Connections: Flanged or welded ends to match piping system.

2.3 PACKLESS EXPANSION JOINTS

- A. Metal, Compensator Packless Expansion Joints:
 - 1. Minimum Pressure Rating: 150 psig, unless otherwise indicated.
 - 2. Description: Totally enclosed, externally pressurized, multi-ply bellows isolated from fluid flow by an internal pipe sleeve and external housing.
 - 3. Joint Axial Movement: 2 inches of compression and 1/2 inch of extension.
 - 4. Configuration for Copper Tubing: Multi-ply, phosphor-bronze bellows with copper pipe ends.
 - a. End Connections for Copper Tubing NPS 2 and Smaller: Solder joint or threaded.
 - b. End Connections for Copper Tubing NPS 2-1/2 to NPS 4: Threaded.
 - 5. Configuration for Steel Piping: Multi-ply, stainless-steel bellows; steel-pipe end connections; and carbon-steel shroud.

- a. End Connections for Steel Pipe NPS 2 and Smaller: Threaded.
 - b. End Connections for Steel Pipe NPS 2-1/2 to NPS 4: Flanged or Threaded.
- B. Rubber Union Connector Expansion Joints RUEJ-01:
- 1. Material: Twin reinforced-rubber spheres.
 - 2. Minimum Pressure Rating: 150 psig at 170 deg F, unless otherwise indicated.
 - 3. End Connections for NPS 2 and Smaller: Threaded.
- C. Flexible-Hose Packless Expansion Joints:
- 1. Description: Manufactured assembly with inlet and outlet elbow fittings and two flexible-metal-hose legs joined by long-radius, 180-degree return bend or center section of flexible hose.
 - 2. Flexible Hose: Corrugated-metal inner hoses and braided outer sheaths.
 - 3. Expansion Joints for Copper Tubing NPS 2 and Smaller: Copper-alloy fittings with solder-joint end connections.
 - a. Bronze hoses and single-braid bronze sheaths with 450 psig at 70 deg F and 340 psig at 450 deg F ratings.
 - 4. Expansion Joints for Copper Tubing NPS 2-1/2 to NPS 4: Copper-alloy fittings with threaded end connections.
 - a. Stainless-steel hoses and single-braid, stainless-steel sheaths with 300 psig at 70 deg F and 225 psig at 450 deg F ratings.
 - 5. Expansion Joints for Steel Piping NPS 2 and Smaller: Carbon-steel fittings with threaded end connections.
 - a. Stainless-steel hoses and single-braid, stainless-steel sheaths with 450 psig at 70 deg F and 325 psig at 600 deg F ratings.
 - 6. Expansion Joints for Steel Piping NPS 2-1/2 to NPS 6: Carbon-steel fittings with flanged end connections.
 - a. Stainless-steel hoses and single-braid, stainless-steel sheaths with 200 psig at 70 deg F and 145 psig at 600 deg F ratings.
- D. Externally Pressurized Metal-Bellows Packless Expansion Joints:
- 1. Minimum Pressure Rating: 150 psig, unless otherwise indicated.
 - 2. Description:
 - a. Totally enclosed, externally pressurized, multi-ply, stainless-steel bellows isolated from fluid flow by an internal pipe sleeve.
 - b. Carbon-steel housing.
 - c. Drain plugs and lifting lug for the NPS 3 and larger.
 - d. Bellows shall have operating clearance between the internal pipe sleeves and the external shrouds.

- e. Joints shall be supplied with a built-in scale to confirm the starting position and operating movement.
 - f. Joint Axial Movement: 6 inches of compression and 1 inch of extension.
- 3. Permanent Locking Bolts: Set locking bolts to maintain joint lengths during installation. Temporary welding tabs that are removed after installation in lieu of locking bolts are not acceptable.
 - 4. End Connection Configuration: Flanged; one raised, fixed and one floating flange.

2.4 ALIGNMENT GUIDES AND ANCHORS

A. Alignment Guides:

- 1. Description: Steel, factory-fabricated alignment guide, with bolted two-section outer cylinder and base for attaching to structure; with two-section guiding slider for bolting to pipe.

B. Anchor Materials:

- 1. Steel Shapes and Plates: ASTM A 36/A 36M.
- 2. Bolts and Nuts: ASME B18.10 or ASTM A 183, steel hex head.
- 3. Washers: ASTM F 844, steel, plain, flat washers.
- 4. Mechanical Fasteners: Insert-wedge-type stud with expansion plug anchor for use in hardened portland cement concrete, with tension and shear capacities appropriate for application.
 - a. Stud: Threaded, zinc-coated carbon steel.
 - b. Expansion Plug: Zinc-coated steel.
 - c. Washer and Nut: Zinc-coated steel.
- 5. Chemical Fasteners: Insert-type stud, bonding-system anchor for use with hardened portland cement concrete, with tension and shear capacities appropriate for application.
 - a. Bonding Material: ASTM C 881/C 881M, Type IV, Grade 3, two-component epoxy resin suitable for surface temperature of hardened concrete where fastener is to be installed.
 - b. Stud: ASTM A 307, zinc-coated carbon steel with continuous thread on stud, unless otherwise indicated.
 - c. Washer and Nut: Zinc-coated steel.

PART 3 - EXECUTION

3.1 EXPANSION JOINT INSTALLATION

- A. Install expansion joints of sizes matching sizes of piping in which they are installed.
- B. Install packed-type expansion joints with packing suitable for fluid service.

- C. Install metal-bellows expansion joints according to EJMA's "Standards of the Expansion Joint Manufacturers Association, Inc."

3.2 PIPE LOOP AND SWING CONNECTION INSTALLATION

- A. Install pipe loops cold-sprung in tension or compression as required to partly absorb tension or compression produced during anticipated change in temperature.
- B. Connect risers and branch connections to mains with at least five pipe fittings, including tee in main.
- C. Connect risers and branch connections to terminal units with at least four pipe fittings, including tee in riser.
- D. Connect mains and branch connections to terminal units with at least four pipe fittings, including tee in main.

3.3 ALIGNMENT-GUIDE AND ANCHOR INSTALLATION

- A. Install alignment guides to guide expansion and to avoid end-loading and torsional stress.
- B. Install two guide(s) on each side of pipe expansion fittings and loops. Install guides nearest to expansion joint not more than four pipe diameters from expansion joint.
- C. Attach guides to pipe, and secure guides to building structure.
- D. Install anchors at locations to prevent stresses from exceeding those permitted by ASME B31.9 and to prevent transfer of loading and stresses to connected equipment.
- E. Anchor Attachments:
 - 1. Anchor Attachment to Steel Pipe: Attach by welding. Comply with ASME B31.9 and ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
 - 2. Anchor Attachment to Copper Tubing: Attach with pipe hangers. Use MSS SP-69, Type 24; U bolts bolted to anchor.
- F. Fabricate and install steel anchors by welding steel shapes, plates, and bars. Comply with ASME B31.9 and AWS D1.1/D1.1M.
 - 1. Anchor Attachment to Steel Structural Members: Attach by welding.
 - 2. Anchor Attachment to Concrete Structural Members: Attach by fasteners. Follow fastener manufacturer's written instructions.
- G. Use grout to form flat bearing surfaces for guides and anchors attached to concrete.

END OF SECTION

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SECTION 230517

SLEEVES AND SLEEVE SEALS FOR HVAC PIPING
(FILED SUB-BID REQUIRED AS PART OF SECTION 23 00 01)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Sub-Bid Requirements: As provided under Section 23 00 01 – Heating, Ventilating and Air Conditioning Filed Sub-Bid Requirements and supplemented under the Bidding Requirements, Contract Forms, and Conditions of the Contract, and applicable parts of Division 1 - General Requirements.
 - 1. Work of this Filed Sub-Bid includes all individual specification sections listed in Section 23 00 01.

1.2 SUMMARY

- A. Section Includes:
 - 1. Sleeves.
 - 2. Sleeve-seal systems.
 - 3. Grout.
 - 4. Silicone sealants.

1.3 SUBMITTALS

- A. Product Data: For each type of product.
- B. Field quality-control reports.

PART 2 - PRODUCTS

2.1 SLEEVES

- A. Cast-Iron Pipe Sleeves: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop collar.
- B. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, anti-corrosion coated or zinc coated, with plain ends and integral welded waterstop collar.
- C. Galvanized-Steel Sheet Pipe Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.
- D. PVC Pipe Sleeves: ASTM D 1785, Schedule 40.

July 11, 2018

2.2 SLEEVE-SEAL SYSTEMS

A. Description:

1. Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.
2. Designed to form a hydrostatic seal of 20-psig.
3. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size.
4. Pressure Plates: Stainless steel.
5. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements.

2.3 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.

2.4 SILICONE SEALANTS

- A. Silicone, S, NS, 25, NT: Single-component, non-sag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant, ASTM C 920, Type S, Grade NS, Class 25, use NT.
- B. Silicone, S, P, 25, T, NT: Single-component, pourable, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade P, Class 25, Uses T and NT. Grade P Pourable (self-leveling) formulation is for opening in floors and other horizontal surfaces that are not fire rated.

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. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.

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.
 2. Using grout or silicone sealant, seal space outside of sleeves in slabs and walls without sleeve-seal system.
- D. Install sleeves for pipes passing through interior partitions.
1. Cut sleeves to length for mounting flush with both surfaces.
 2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
 3. Seal annular space between sleeve and piping or piping insulation; use sealants appropriate for size, depth, and location of joint.
- E. Fire-Resistance-Rated Penetrations, Horizontal Assembly Penetrations, and Smoke-Barrier Penetrations: Maintain indicated fire or smoke rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with fire- and smoke-stop materials.

3.2 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.

3.3 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 1. Leak Test: After allowing for a full cure, test sleeves and sleeve seals for leaks. Repair leaks and retest until no leaks exist.
- B. Sleeves and sleeve seals will be considered defective if they do not pass tests and inspections.

3.4 SLEEVE AND SLEEVE-SEAL SCHEDULE

- A. Use sleeves and sleeve seals for the following piping-penetration applications:
 1. Concrete Slabs Above Grade:
 - a. Piping Smaller Than NPS 6: Steel-pipe sleeves or PVC-pipe sleeves.
 - b. Piping NPS 6 and Larger: Steel-pipe sleeves or PVC-pipe sleeves.
 2. Interior Partitions:

July 11, 2018

POPE'S TAVERN
ADDITION/RENOVATION
Halifax, Massachusetts

- a. Piping Smaller Than NPS 6: Galvanized-steel pipe sleeves or PVC-pipe sleeves.
- b. Piping NPS 6 and Larger: Galvanized-steel sheet sleeves.

END OF SECTION

SECTION 230518

ESCUTCHEONS FOR HVAC PIPING
(FILED SUB-BID REQUIRED AS PART OF SECTION 23 00 01)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Sub-Bid Requirements: As provided under Section 23 00 01 – Heating, Ventilating and Air Conditioning Filed Sub-Bid Requirements and supplemented under the Bidding Requirements, Contract Forms, and Conditions of the Contract, and applicable parts of Division 1 - General Requirements.
 - 1. Work of this Filed Sub-Bid includes all individual specification sections listed in Section 23 00 01.

1.2 SUMMARY

- A. Section Includes:
 - 1. Escutcheons.
 - 2. Floor plates.

1.3 SUBMITTALS

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

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. BrassCraft Manufacturing Co.; a Masco company.
 - 2. Dearborn Brass.
 - 3. Jones Stephens Corp.
 - 4. Keeney Manufacturing Company (The).
 - 5. Mid-America Fittings, Inc.
 - 6. ProFlo; a Ferguson Enterprises, Inc. brand.

2.2 ESCUTCHEONS

- A. One-Piece, Steel Type: With polished, chrome-plated finish and setscrew fastener.
- B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped steel with polished, chrome-plated finish and spring-clip fasteners.
- C. One-Piece, Stamped-Steel Type: With polished, chrome-plated finish and spring-clip fasteners.
- D. Split-Plate, Stamped-Steel Type: With polished, chrome-plated finish; concealed and exposed-rivet hinge; and spring-clip fasteners.

2.3 FLOOR PLATES

- A. Split Floor Plates: Steel 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.
 - 1. Escutcheons for New Piping and Relocated Existing Piping:
 - a. Piping with Fitting or Sleeve Protruding from Wall: One-piece deep pattern.
 - b. Chrome-Plated Piping: One-piece steel or split-plate steel with polished, chrome-plated finish.
 - c. Insulated Piping: One-piece steel with polished, chrome-plated finish.
 - d. Insulated Piping: One-piece stamped steel or split-plate, stamped steel with concealed hinge with polished, chrome-plated finish.
 - e. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece steel with polished, chrome-plated finish.
 - f. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece stamped steel or split-plate, stamped steel with concealed hinge with polished, chrome-plated finish.
 - g. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece steel with polished, chrome-plated finish.
 - h. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece stamped steel or split-plate, stamped steel with concealed hinge with polished, chrome-plated finish.
 - 2. Escutcheons for Existing Piping to Remain:
 - a. Chrome-Plated Piping: Split-plate, stamped steel with concealed hinge with polished, chrome-plated finish.
 - b. Insulated Piping: Split-plate, stamped steel with concealed hinge with polished, chrome-plated finish.

- c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-plate, stamped steel with concealed hinge with polished, chrome-plated finish.
 - d. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-plate, stamped steel with concealed hinge with polished, chrome-plated finish.
- C. Install floor plates for piping penetrations of equipment-room floors.
- D. 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 and Relocated Existing Piping: Split floor plate.
 - 2. Existing Piping to Remain: Split floor plate.

3.2 FIELD QUALITY CONTROL

- A. Using new materials, replace broken and damaged escutcheons and floor plates.

END OF SECTION

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SECTION 230519

METERS AND GAGES FOR HVAC PIPING
(FILED SUB-BID REQUIRED AS PART OF SECTION 23 00 01)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Sub-Bid Requirements: As provided under Section 23 00 01 – Heating, Ventilating and Air Conditioning Filed Sub-Bid Requirements and supplemented under the Bidding Requirements, Contract Forms, and Conditions of the Contract, and applicable parts of Division 1 - General Requirements.
 - 1. Work of this Filed Sub-Bid includes all individual specification sections listed in Section 23 00 01.

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.

1.3 SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings:
 - 1. Include diagrams for power, signal, and control wiring.
- C. Product Certificates: For each type of meter and gage.
- D. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 THERMOWELLS

- A. Thermowells:
 - 1. Standard: ASME B40.200.
 - 2. Description: Pressure-tight, socket-type fitting made for insertion in piping tee fitting.

July 11, 2018

3. Material for Use with Copper Tubing: CNR or CUNI.
4. Material for Use with Steel Piping: CRES.
5. Type: Stepped shank unless straight or tapered shank is indicated.
6. External Threads: NPS 1/2, NPS 3/4, or NPS 1
7. ASME B1.20.1 pipe threads.
8. Internal Threads: 1/2, 3/4, and 1 inch with ASME B1.1 screw threads.
9. Bore: Diameter required to match thermometer bulb or stem.
10. Insertion Length: Length required to match thermometer bulb or stem.
11. Lagging Extension: Include on thermowells for insulated piping and tubing.
12. Bushings: For converting size of thermowell's internal screw thread to size of thermometer connection.

- B. Heat-Transfer Medium: Mixture of graphite and glycerin

2.2 DIAL-TYPE PRESSURE GAGES

- A. Direct-Mounted, Metal-Case, Dial-Type Pressure Gages:

1. Standard: ASME B40.100.
2. Case: Liquid-filled type; cast aluminum or drawn steel 4-1/2-inch nominal diameter.
3. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
4. Pressure Connection: Brass, with NPS 1/4 or NPS 1/2, 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: Metal.

- B. Direct-Mounted, Plastic-Case, Dial-Type Pressure Gages:

1. Standard: ASME B40.100.
2. Case: Liquid-filled type; cast aluminum or drawn steel 4-1/2-inch nominal diameter.
3. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
4. Pressure Connection: Brass, with NPS 1/4 or NPS 1/2, 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: Metal.

2.3 GAGE ATTACHMENTS

- A. Snubbers: ASME B40.100, brass; with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads and piston-type surge-dampening device. Include extension for use on insulated piping.
- B. Siphons: Loop-shaped section of brass pipe with NPS 1/4 or NPS 1/2 pipe threads.
- C. Valves: Brass ball, with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install thermowells with socket extending to center of pipe 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 duct-thermometer mounting brackets in walls of ducts. Attach to duct with screws.
- H. Install direct-mounted pressure gages in piping tees with pressure gage located on pipe at the most readable position.
- I. Install remote-mounted pressure gages on panel.
- J. Install valve and snubber in piping for each pressure gage for fluids (except steam).
- K. Install valve and syphon fitting in piping for each pressure gage for steam.
- L. Install test plugs in piping tees.
- M. Install permanent indicators on walls or brackets in accessible and readable positions.
- N. Install connection fittings in accessible locations for attachment to portable indicators.
- O. Install thermometers in the following locations:
 - 1. Inlet and outlet of each hydronic zone.
 - 2. Inlet and outlet of each hydronic boiler.
 - 3. Two inlets and two outlets of each chiller.
 - 4. Inlet and outlet of each hydronic coil in air-handling units.
 - 5. Two inlets and two outlets of each hydronic heat exchanger.
 - 6. Inlet and outlet of each thermal-storage tank.
 - 7. Outside-, return-, supply-, and mixed-air ducts.
- P. Install pressure gages in the following locations:
 - 1. Discharge of each pressure-reducing valve.
 - 2. Inlet and outlet of each chiller chilled-water and condenser-water connection.
 - 3. Suction and discharge of each pump.
 - 4. As indicated in the inline pump detail found on H-003.

July 11, 2018

3.2 CONNECTIONS

- A. Install meters and gages adjacent to machines and equipment to allow space for service and maintenance of meters, gages, machines, and equipment.

3.3 ADJUSTING

- A. After installation, calibrate meters according to manufacturer's written instructions.
- B. Adjust faces of meters and gages to proper angle for best visibility.

3.4 THERMOMETER SCHEDULE

- A. Thermometers at inlet and outlet of each hydronic zone shall be one of the following:
 - 1. Liquid-filled, bimetallic-actuated type.
 - 2. Direct-mounted, metal-case, vapor-actuated type.
- B. Thermometers at inlet and outlet of each hydronic boiler shall be one of the following:
 - 1. Liquid-filled, bimetallic-actuated type.
 - 2. Direct-mounted, metal-case, vapor-actuated type.
- C. Thermometers at inlet and outlet of each hydronic coil in air-handling units and built-up central systems shall be one of the following:
 - 1. Liquid-filled, bimetallic-actuated type.
 - 2. Direct-mounted, metal-case, vapor-actuated type.
- D. Thermometer stems shall be of length to match thermowell insertion length.

3.5 THERMOMETER SCALE-RANGE SCHEDULE

- A. Scale Range for Heating, Hot-Water Piping: 0 to 250 deg F
- B. Scale Range for Air Ducts: Minus 40 to plus 160 deg F

3.6 PRESSURE-GAGE SCHEDULE

- A. Pressure gages at discharge of each pressure-reducing valve shall be the following:
 - 1. Liquid-filled, direct-mounted, metal case.
- B. Pressure gages at suction and discharge of each pump shall be the following:
 - 1. Liquid-filled, direct or remote-mounted, metal case.

July 11, 2018

POPE'S TAVERN
ADDITION/RENOVATION
Halifax, Massachusetts

3.7 PRESSURE-GAGE SCALE-RANGE SCHEDULE

- A. Scale Range for Heating, Hot-Water Piping: 0 to 160 psi.

END OF SECTION 230519

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SECTION 230523.12

BALL VALVES FOR HVAC PIPING
(FILED SUB-BID REQUIRED AS PART OF SECTION 23 00 01)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Sub-Bid Requirements: As provided under Section 23 00 01 – Heating, Ventilating and Air Conditioning Filed Sub-Bid Requirements and supplemented under the Bidding Requirements, Contract Forms, and Conditions of the Contract, and applicable parts of Division 1 - General Requirements.
 - 1. Work of this Filed Sub-Bid includes all individual specification sections listed in Section 23 00 01.

1.2 SUMMARY

- A. Section Includes:
 - 1. Brass ball valves.
 - 2. Bronze ball valves.

1.3 SUBMITTALS

- A. Product Data: For each type of valve.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

- A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.
- B. ASME Compliance:
 - 1. ASME B1.20.1 for threads for threaded-end valves.
 - 2. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
 - 3. ASME B16.18 for solder-joint connections.
 - 4. ASME B31.1 for power piping valves.
 - 5. ASME B31.9 for building services piping valves.
- C. Bronze valves shall be made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted.
- D. Refer to HVAC valve schedule articles for applications of valves.

- E. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- F. Valve Sizes: Same as upstream piping unless otherwise indicated.
- G. Valve Actuator Types:
 - 1. Handlever: For quarter-turn valves smaller than NPS 4.
- H. Valves in Insulated Piping:
 - 1. Include 2-inch stem extensions.
 - 2. Extended operating handle of nonthermal-conductive material, and protective sleeves that allow operation of valves without breaking the vapor seals or disturbing insulation.
 - 3. Memory stops that are fully adjustable after insulation is applied.
- I. Valve Bypass and Drain Connections: MSS SP-45.

2.2 BRASS BALL VALVES

- A. Brass Ball Valves, One Piece:
 - 1. Description:
 - a. Standard: MSS SP-110.
 - b. CWP Rating: 400 psig.
 - c. Body Design: One piece.
 - d. Body Material: Forged brass.
 - e. Ends: Threaded.
 - f. Seats: PTFE.
 - g. Stem: Brass.
 - h. Ball: Chrome-plated brass.
 - i. Port: Reduced.
- B. Brass Ball Valves, Two-Piece with Full Port and Brass Trim:
 - 1. Description:
 - a. Standard: MSS SP-110.
 - b. SWP Rating: 150 psig
 - c. CWP Rating: 600 psig
 - d. Body Design: Two piece.
 - e. Body Material: Forged brass.
 - f. Ends: Threaded.
 - g. Seats: PTFE.
 - h. Stem: Brass.
 - i. Ball: Chrome-plated brass.
 - j. Port: Full.
- C. Brass Ball Valves, Two-Piece with Regular Port and Brass Trim:
 - 1. Description:

- a. Standard: MSS SP-110.
- b. SWP Rating: 150 psig
- c. CWP Rating: 600 psig
- d. Body Design: Two piece.
- e. Body Material: Forged brass.
- f. Ends: Threaded.
- g. Seats: PTFE.
- h. Stem: Brass.
- i. Ball: Chrome-plated brass.
- j. Port: Regular.

2.3 BRONZE BALL VALVES

A. Bronze Ball Valves, One-Piece with Bronze Trim:

1. Description:

- a. Standard: MSS SP-110.
- b. CWP Rating: 400 psig
- c. Body Design: One piece.
- d. Body Material: Bronze.
- e. Ends: Threaded.
- f. Seats: PTFE.
- g. Stem: Bronze.
- h. Ball: Chrome-plated brass.
- i. Port: Reduced.

B. Bronze Ball Valves, Two-Piece with Full Port and Bronze or Brass Trim:

1. Description:

- a. Standard: MSS SP-110.
- b. SWP Rating: 150 psig
- c. CWP Rating: 600 psig
- d. Body Design: Two piece.
- e. Body Material: Bronze.
- f. Ends: Threaded.
- g. Seats: PTFE.
- h. Stem: Bronze.
- i. Ball: Chrome-plated brass.
- j. Port: Full.

C. Bronze Ball Valves, Two-Piece with Regular Port and Bronze or Brass Trim:

1. Description:

- a. Standard: MSS SP-110.
- b. SWP Rating: 150 psig
- c. CWP Rating: 600 psig
- d. Body Design: Two piece.
- e. Body Material: Bronze.
- f. Ends: Threaded.

- g. Seats: PTFE.
- h. Stem: Bronze.
- i. Ball: Chrome-plated brass.
- j. Port: Regular.

PART 3 - EXECUTION

2.4 VALVE INSTALLATION

- A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- B. Locate valves for easy access and provide separate support where necessary.
- C. Install valves in horizontal piping with stem at or above center of pipe.
- D. Install valves in position to allow full stem movement.

2.5 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

- A. If valves with specified SWP classes or CWP ratings are unavailable, the same types of valves with higher SWP classes or CWP ratings may be substituted.
- B. Select valves with the following end connections:
 - 1. For Copper Tubing, NPS 2 and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.
 - 2. For Steel Piping, NPS 2 and Smaller: Threaded ends.

2.6 HEATING-WATER VALVE SCHEDULE

- A. Pipe NPS 2 and Smaller: Brass or bronze ball valves, one or two piece, with bronze trim, and full port.
 - 1. Valves may be provided with solder-joint ends instead of threaded ends.

END OF SECTION 230523.12

SECTION 230523.14

CHECK VALVES FOR HVAC PIPING
(FILED SUB-BID REQUIRED AS PART OF SECTION 23 00 01)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Sub-Bid Requirements: As provided under Section 23 00 01 – Heating, Ventilating and Air Conditioning Filed Sub-Bid Requirements and supplemented under the Bidding Requirements, Contract Forms, and Conditions of the Contract, and applicable parts of Division 1 - General Requirements.
 - 1. Work of this Filed Sub-Bid includes all individual specification sections listed in Section 23 00 01.

1.2 SUMMARY

- A. Section Includes:
 - 1. Bronze lift check valves.
 - 2. Bronze swing check valves.

1.3 SUBMITTALS

- A. Product Data: For each type of valve.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

- A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.
- B. ASME Compliance:
 - 1. ASME B1.20.1 for threads for threaded-end valves.
 - 2. ASME B16.1 for flanges on iron valves.
 - 3. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
 - 4. ASME B16.18 for solder joint.
 - 5. ASME B31.1 for power piping valves.
 - 6. ASME B31.9 for building services piping valves.
- C. Bronze valves shall be made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted.

- D. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- E. Valve Sizes: Same as upstream piping unless otherwise indicated.
- F. Valve Bypass and Drain Connections: MSS SP-45.

2.2 BRONZE SWING CHECK VALVES

- A. Bronze Swing Check Valves with Bronze Disc, Class 125:
 - 1. Description:
 - a. Standard: MSS SP-80, Type 3.
 - b. CWP Rating: 200 psig
 - c. Body Design: Horizontal flow.
 - d. Body Material: ASTM B 62, bronze.
 - e. Ends: Threaded.
 - f. Disc: Bronze.

PART 3 - EXECUTION

3.1 VALVE INSTALLATION

- A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- B. Locate valves for easy access and provide separate support where necessary.
- C. Install valves in horizontal piping with stem at or above center of pipe.
- D. Install valves in position to allow full stem movement.
- E. Install swing check valves for proper direction of flow in horizontal position with hinge pin level.

3.2 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.

3.3 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

- A. If valve applications are not indicated, use the following:
 - 1. Pump-Discharge Check Valves:
 - a. NPS 2 and Smaller: Bronze swing check valves with bronze or nonmetallic disc.

July 11, 2018

POPE'S TAVERN
ADDITION/RENOVATION
Halifax, Massachusetts

- B. If valves with specified SWP classes or CWP ratings are unavailable, the same types of valves with higher SWP classes or CWP ratings may be substituted.
- C. Select valves, except wafer types, with the following end connections:
 - 1. For Copper Tubing, NPS 2 and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules.
 - 2. For Steel Piping, NPS 2 and Smaller: Threaded ends.

3.4 HEATING-WATER VALVE SCHEDULE

- A. Pipe NPS 2 and Smaller:
 - 1. Bronze Valves: May be provided with solder-joint ends instead of threaded ends.
 - 2. Bronze swing check valves with bronze or nonmetallic disc, Class 125.

END OF SECTION 230523.14

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SECTION 230529

HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT
(FILED SUB-BID REQUIRED AS PART OF SECTION 23 00 01)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Sub-Bid Requirements: As provided under Section 23 00 01 – Heating, Ventilating and Air Conditioning Filed Sub-Bid Requirements and supplemented under the Bidding Requirements, Contract Forms, and Conditions of the Contract, and applicable parts of Division 1 - General Requirements.
 - 1. Work of this Filed Sub-Bid includes all individual specification sections listed in Section 23 00 01.

1.2 SUMMARY

- A. Section Includes:
 - 1. Metal pipe hangers and supports.
 - 2. Trapeze pipe hangers.
 - 3. Thermal-hanger shield inserts.
 - 4. Fastener systems.
 - 5. Equipment supports.
- B. Related Requirements:
 - 1. Section 230516 "Expansion Fittings and Loops for HVAC Piping" for pipe guides and anchors.
 - 2. Section 230548 "Vibration and Seismic Controls for HVAC" for vibration isolation devices.
 - 3. Section 233113 "Metal Ducts" for duct hangers and supports.

1.3 SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Show fabrication and installation details and include calculations for the following; include Product Data for components:
 - 1. Trapeze pipe hangers.
 - 2. Equipment supports.
- C. Welding certificates.

July 11, 2018

1.4 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, Section IX.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer to design trapeze pipe hangers and equipment supports.
- 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 and obtain approval from authorities having jurisdiction.

2.2 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: Pregalvanized, hot-dip galvanized, or electro-galvanized.
 - 3. Nonmetallic Coatings: Plastic coated, or epoxy powder-coated.
 - 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 and Tube Hangers:
 - 1. Description: MSS SP-58, Types 1 through 58, copper-plated steel, factory-fabricated components.
 - 2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-plated steel.

2.3 TRAPEZE PIPE HANGERS

- A. Description: MSS SP-58, 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.

July 11, 2018

2.4 THERMAL-HANGER SHIELD INSERTS

- A. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psi minimum compressive strength and vapor barrier.
- B. Insulation-Insert Material for Hot Piping: ASTM C 552, Type II cellular glass with 100-psi 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 beyond sheet metal shield for piping operating below ambient air temperature.

2.5 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, 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.

2.6 EQUIPMENT SUPPORTS

- A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.7 MATERIALS

- A. Aluminum: ASTM B 221.
- B. Carbon Steel: ASTM A 1011/A 1011M.
- C. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.
- D. Stainless Steel: ASTM A 240/A 240M.
- E. Grout: ASTM C 1107/C 1107M, 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, 28-day compressive strength.

PART 3 - EXECUTION

3.1 APPLICATION

- A. 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.

3.2 HANGER AND SUPPORT INSTALLATION

- A. Metal Pipe-Hanger Installation: Comply with MSS SP-58. 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-58. 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. Fiberglass Pipe-Hanger Installation: Comply with applicable portions of MSS SP-58. Install hangers and attachments as required to properly support piping from building structure.
- D. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled strut systems.
- E. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
- F. Fastener System Installation:
 - 1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches 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.
- G. 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.
- H. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

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- I. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
 - J. 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.
 - K. Install lateral bracing with pipe hangers and supports to prevent swaying.
 - L. 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 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.
 - M. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
 - N. 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.
 - O. 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 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 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: 12 inches long and 0.048 inch thick.
 - b. NPS 4: 12 inches long and 0.06 inch thick.
 - c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
 - d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
 - e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.
 - 5. Pipes NPS 8 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.

July 11, 2018

3.3 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.

3.4 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
- C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.5 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.

3.6 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.
- B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780/A 780M.

July 11, 2018

3.7 HANGER AND SUPPORT SCHEDULE

- A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-58 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 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.
 - 2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F, pipes NPS 4 to NPS 24, requiring up to 4 inches of insulation.
 - 3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36, requiring clamp flexibility and up to 4 inches of insulation.
 - 4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 if little or no insulation is required.
 - 5. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4, 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.
 - 7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
 - 8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
 - 9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
 - 10. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 8.
 - 11. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 3.
 - 12. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.
 - 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, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.

July 11, 2018

15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36, 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 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, 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, 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 if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is unnecessary.
 20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes NPS 2 to NPS 24 if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is unnecessary.
 21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes NPS 2 to NPS 30 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.
 2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 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 for heavy loads.
 2. Steel Clevises (MSS Type 14): For 120 to 450 deg F 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 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.

July 11, 2018

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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.
 - b. Medium (MSS Type 32): 1500 lb.
 - c. Heavy (MSS Type 33): 3000 lb.
 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.
 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:

July 11, 2018

POPE'S TAVERN
ADDITION/RENOVATION
Halifax, Massachusetts

- 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-58 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.
- P. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

END OF SECTION

SECTION 230548

VIBRATION AND SEISMIC CONTROLS FOR HVAC
(FILED SUB-BID REQUIRED AS PART OF SECTION 23 00 01)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Sub-Bid Requirements: As provided under Section 23 00 01 – Heating, Ventilating and Air Conditioning Filed Sub-Bid Requirements and supplemented under the Bidding Requirements, Contract Forms, and Conditions of the Contract, and applicable parts of Division 1 - General Requirements.
 - 1. Work of this Filed Sub-Bid includes all individual specification sections listed in Section 23 00 01.

1.2 SUMMARY

- A. Section Includes:
 - 1. Elastomeric isolation pads.
 - 2. Elastomeric isolation mounts.
 - 3. Restrained elastomeric isolation mounts.
 - 4. Open-spring isolators.
 - 5. Housed-spring isolators.
 - 6. Restrained-spring isolators.
 - 7. Housed-restrained-spring isolators.
 - 8. Pipe-riser resilient supports.
 - 9. Resilient pipe guides.
 - 10. Elastomeric hangers.
 - 11. Spring hangers.
 - 12. Snubbers.
 - 13. Restraint channel bracings.
 - 14. Restraint cables.
 - 15. Seismic-restraint accessories.
 - 16. Mechanical anchor bolts.

1.3 SUBMITTALS

- A. Product Data: For each type of product.
- B. Delegated-Design Submittal: For each vibration isolation and seismic-restraint device.

July 11, 2018

1. Include design calculations and details for selecting vibration isolators and seismic restraints complying with performance requirements, design criteria, and analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 - C. Welding certificates.
 - D. 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 and shall bear anchorage preapproval OPA number from OSHPD, preapproval by ICC-ES, or preapproval by another agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are unavailable, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer.

PART 2 - PRODUCTS

2.1 ELASTOMERIC ISOLATION PADS

- A. Elastomeric Isolation Pads
 1. Fabrication: Single or multiple layers of sufficient durometer stiffness for uniform loading over pad area.
 2. Size: Factory or field cut to match requirements of supported equipment.
 3. Pad Material: Oil and water resistant with elastomeric properties.
 4. Surface Pattern: Ribbed pattern.
 5. Infused nonwoven cotton or synthetic fibers.
 6. Load-bearing metal plates adhered to pads.

2.2 ELASTOMERIC ISOLATION MOUNTS

- A. Double-Deflection, Elastomeric Isolation Mounts:
 1. Mounting Plates:

- a. Top Plate: Encapsulated steel load transfer top plates, factory drilled and threaded with threaded studs or bolts.
 - b. Baseplate: Encapsulated steel bottom plates with holes provided for anchoring to support structure.
2. Elastomeric Material: Molded, oil-resistant rubber, neoprene, or other elastomeric material.

2.3 RESTRAINED ELASTOMERIC ISOLATION MOUNTS

A. Restrained Elastomeric Isolation Mounts:

1. Description: All-directional isolator with seismic restraints containing two separate and opposing elastomeric elements that prevent central threaded element and attachment hardware from contacting the housing during normal operation.
 - a. Housing: Cast-ductile iron or welded steel.
 - b. Elastomeric Material: Molded, oil-resistant rubber, neoprene, or other elastomeric material.

2.4 OPEN-SPRING ISOLATORS

A. 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 rated vertical stiffness.
4. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
5. Baseplates: Factory-drilled steel plate for bolting to structure with an elastomeric isolator pad attached to the underside. Baseplates shall limit floor load to 500 psig.
6. Top Plate and Adjustment Bolt: Threaded top plate with adjustment bolt and cap screw to fasten and level equipment.

2.5 HOUSED-SPRING ISOLATORS

A. Freestanding, Laterally Stable, Open-Spring Isolators in Two-Part Telescoping Housing:

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 rated vertical stiffness.
4. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

5. Two-Part Telescoping Housing: A steel top and bottom frame separated by an elastomeric material and enclosing the spring isolators.
 - a. Drilled base housing for bolting to structure with an elastomeric isolator pad attached to the underside. Bases shall limit floor load to 500 psig.
 - b. Top housing with attachment and leveling bolt.

2.6 RESTRAINED-SPRING ISOLATORS

A. Freestanding, Laterally Stable, Open-Spring Isolators with Vertical-Limit Stop Restraint:

1. Housing: Steel housing with vertical-limit stops to prevent spring extension due to weight being removed.
 - a. Base with holes for bolting to structure with an elastomeric isolator pad attached to the underside. Bases shall limit floor load to 500 psig.
 - b. Top plate with threaded mounting holes.
 - c. Internal leveling bolt that acts as blocking during installation.
2. Restraint: Limit stop as required for equipment and authorities having jurisdiction.
3. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
4. Minimum Additional Travel: 50 percent of the required deflection at rated load.
5. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
6. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

2.7 HOUSED-RESTRAINED-SPRING ISOLATORS

A. Freestanding, Steel, Open-Spring Isolators with Vertical-Limit Stop Restraint in Two-Part Telescoping Housing:

1. Two-Part Telescoping Housing: A steel top and bottom frame separated by an elastomeric material and enclosing the spring isolators. Housings are equipped with adjustable snubbers to limit vertical movement.
 - a. Drilled base housing for bolting to structure with an elastomeric isolator pad attached to the underside. Bases shall limit floor load to 500 psig.
 - b. Threaded top housing with adjustment bolt and cap screw to fasten and level equipment.
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 rated vertical stiffness.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

July 11, 2018

2.8 PIPE-RISER RESILIENT SUPPORT

- A. Description: All-directional, acoustical pipe anchor consisting of two steel tubes separated by a minimum 1/2-inch-thick neoprene
1. Vertical-Limit Stops: Steel and neoprene vertical-limit stops arranged to prevent vertical travel in both directions.
 2. Maximum Load Per Support: 500 psig on isolation material providing equal isolation in all directions.

2.9 RESILIENT PIPE GUIDES

- A. Description: Telescopic arrangement of two steel tubes or post and sleeve arrangement separated by a minimum 1/2-inch-thick neoprene
1. Factory-Set Height Guide with Shear Pin: Shear pin shall be removable and reinsertable to allow for selection of pipe movement. Guides shall be capable of motion to meet location requirements.

2.10 ELASTOMERIC HANGERS

- A. Elastomeric Mount in a Steel Frame with Upper and Lower Steel Hanger Rods:
1. Frame: Steel, fabricated with a connection for an upper threaded hanger rod and an opening on the underside to allow for a maximum of 30 degrees of angular lower hanger-rod misalignment without binding or reducing isolation efficiency.
 2. Dampening Element: Molded, oil-resistant rubber, neoprene, or other elastomeric material with a projecting bushing for the underside opening preventing steel to steel contact.

2.11 SPRING HANGERS

- A. 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 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.

July 11, 2018

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7. Adjustable Vertical Stop: Steel washer with neoprene washer "up-stop" on lower threaded rod.
 8. Self-centering hanger-rod cap to ensure concentricity between hanger rod and support spring coil.

2.12 SNUBBERS

- A. Description: Factory fabricated using welded structural-steel shapes and plates, anchor bolts, and replaceable resilient isolation washers and bushings.
 1. Anchor bolts for attaching to concrete shall be seismic-rated, drill-in, and stud-wedge or female-wedge type.
 2. Resilient Isolation Washers and Bushings: Oil- and water-resistant neoprene.
 3. Maximum 1/4-inch air gap, and minimum 1/4-inch-thick resilient cushion.

2.13 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 and other matching components and with corrosion-resistant coating; rated in tension, compression, and torsion forces.

2.14 RESTRAINT CABLES

- A. Restraint Cables: ASTM A 603 galvanized-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.

2.15 SEISMIC-RESTRAINT ACCESSORIES

- A. Hanger-Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections to hanger rod.
- B. 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.
- C. 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.
- D. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.
- E. 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.

PART 3 - EXECUTION

3.1 APPLICATIONS

- A. Multiple Pipe Supports: Secure pipes to trapeze member with clamps approved for application by an evaluation service member of ICC-ES.
- B. 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 due to seismic forces.
- C. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength is adequate to carry present and future static and seismic loads within specified loading limits.

3.2 VIBRATION CONTROL AND SEISMIC-RESTRAINT DEVICE INSTALLATION

- A. Coordinate the location of embedded connection hardware with supported equipment attachment and mounting points and with requirements for concrete reinforcement and formwork.
- B. Installation of vibration isolators must not cause any change of position of equipment, piping, or ductwork resulting in stresses or misalignment.
- C. Equipment Restraints:
 - 1. Install seismic snubbers on HVAC equipment mounted on vibration isolators. Locate snubbers as close as possible to vibration isolators and bolt to equipment base and supporting structure.
 - 2. Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch.
 - 3. Install seismic-restraint devices using methods approved by an evaluation service member of ICC-ES that provides required submittals for component.
- D. Piping Restraints:
 - 1. Comply with requirements in MSS SP-127.
 - 2. Space lateral supports a maximum of 40 feet o.c., and longitudinal supports a maximum of 80 feet o.c.
 - 3. Brace a change of direction longer than 12 feet.
- E. Install cables so they do not bend across edges of adjacent equipment or building structure.
- F. Install seismic-restraint devices using methods approved by an evaluation service member of ICC-ES that provides required submittals for component.
- G. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.

- H. 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.
- I. 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.
- J. 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. Set anchors to manufacturer's recommended torque, using a torque wrench.
 - 5. 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 piping where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where the connections terminate with connection to equipment that is anchored to a different structural element from the one supporting the connections as they approach equipment. Comply with requirements in Section 232113 "Hydronic Piping" for piping flexible connections.

3.4 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. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
 - 2. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless postconnection testing has been approved), and with at least seven days' advance notice.
 - 3. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.
 - 4. Test at least four of each type and size of installed anchors and fasteners selected by Architect.
 - 5. Test to 90 percent of rated proof load of device.
 - 6. Measure isolator restraint clearance.

7. Measure isolator deflection.
 8. Verify snubber minimum clearances.
- D. Remove and replace malfunctioning units and retest as specified above.
- E. Prepare test and inspection reports.

3.5 ADJUSTING

- A. Adjust isolators after piping system 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.

END OF SECTION

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SECTION 230553

IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT
(FILED SUB-BID REQUIRED AS PART OF SECTION 23 00 01)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Sub-Bid Requirements: As provided under Section 23 00 01 – Heating, Ventilating and Air Conditioning Filed Sub-Bid Requirements and supplemented under the Bidding Requirements, Contract Forms, and Conditions of the Contract, and applicable parts of Division 1 - General Requirements.
 - 1. Work of this Filed Sub-Bid includes all individual specification sections listed in Section 23 00 01.

1.2 SUMMARY

- A. Section Includes:
 - 1. Equipment labels.
 - 2. Warning signs and labels.
 - 3. Pipe labels.
 - 4. Duct labels.

1.3 SUBMITTALS

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

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

- A. Metal Labels for Equipment:
 - 1. Material and Thickness: Brass, 0.032-inch or aluminum, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
 - 2. Letter Color: White.
 - 3. Background Color: Black.
 - 4. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
 - 5. Minimum Letter Size: 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-quarters the size of principal lettering.

6. Fasteners: Stainless-steel rivets.
7. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Plastic Labels for Equipment:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.
2. Letter Color: White.
3. Background Color: Black.
4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
6. Minimum Letter Size: 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-quarters the size of principal lettering.
7. Fasteners: Stainless-steel rivets.
8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

C. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), and the Specification Section number and title where equipment is specified.

D. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number, and identify Drawing numbers where equipment is indicated (plans, details, and schedules) and the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 WARNING SIGNS AND LABELS

- A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.
- B. Letter Color: White.
- C. Background Color: Red.
- D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
- E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
- F. Minimum Letter Size: 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-quarters the size of principal lettering.
- G. Fasteners: Stainless-steel rivets.
- H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

July 11, 2018

- I. Label Content: Include caution and warning information plus emergency notification instructions.

2.3 PIPE LABELS

- A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction according to ASME A13.1.
- B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.
- C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.
- D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings; also include pipe size and an arrow indicating flow direction.
 - 1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions or as separate unit on each pipe label to indicate flow direction.
 - 2. Lettering Size: Size letters according to ASME A13.1 for piping.

2.4 DUCT LABELS

- A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.
- B. Letter Color: White.
- C. Background Color: Black.
- D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
- E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
- F. Minimum Letter Size: 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-quarters the size of principal lettering.
- G. Fasteners: Stainless-steel rivets.
- H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- I. Duct Label Contents: Include identification of duct service using same designations or abbreviations as used on Drawings; also include duct size and an arrow indicating flow direction.
 - 1. Flow-Direction Arrows: Integral with duct system service lettering to accommodate both directions or as separate unit on each duct label to indicate flow direction.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 EQUIPMENT LABEL INSTALLATION

- A. Install or permanently fasten labels on each major item of mechanical equipment.
- B. Locate equipment labels where accessible and visible.

3.3 PIPE LABEL INSTALLATION

- A. Pipe Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed 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 and on both sides of through walls, floors, ceilings, and inaccessible 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 labels.
- B. Pipe Label Color Schedule:
 - 1. Heating Water Piping: White letters on a black background.

3.4 DUCT LABEL INSTALLATION

- A. Install plastic-laminated duct labels with permanent adhesive on air ducts in the following color codes:
 - 1. Black: For exhaust-, outside-, relief-, return-, and mixed-air ducts.
- B. Locate labels near points where ducts enter into and exit from concealed spaces and at maximum intervals of 50 feet in each space where ducts are exposed or concealed by removable ceiling system.

END OF SECTION

SECTION 230593

TESTING, ADJUSTING, AND BALANCING FOR HVAC
(FILED SUB-BID REQUIRED AS PART OF SECTION 23 00 01)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Sub-Bid Requirements: As provided under Section 23 00 01 – Heating, Ventilating and Air Conditioning Filed Sub-Bid Requirements and supplemented under the Bidding Requirements, Contract Forms, and Conditions of the Contract, and applicable parts of Division 1 - General Requirements.
 - 1. Work of this Filed Sub-Bid includes all individual specification sections listed in Section 23 00 01.

1.2 SUMMARY

- A. Section Includes:
 - 1. Balancing Air Systems:
 - a. Constant-volume air systems.
 - 2. Balancing Hydronic Piping Systems:
 - a. Constant-flow hydronic systems.
 - b. Variable-flow hydronic systems.

1.3 DEFINITIONS

- A. AABC: Associated Air Balance Council.
- B. NEBB: National Environmental Balancing Bureau.
- C. TAB: Testing, adjusting, and balancing.
- D. TABB: Testing, Adjusting, and Balancing Bureau.
- E. TAB Specialist: An independent entity meeting qualifications to perform TAB work.
- F. TDH: Total dynamic head.

July 11, 2018

1.4 SUBMITTALS

- A. TAB Report: Documentation indicating that Work complies with ASHRAE/IES 90.1, Section 6.7.2.3 - "System Balancing."
- B. Strategies and Procedures Plan: Within 60 days of Contractor's Notice to Proceed, submit TAB strategies and step-by-step procedures as specified in "Preparation" Article.
- C. Certified TAB reports.

1.5 QUALITY ASSURANCE

- A. TAB Specialists Qualifications: Certified by AABC.
 - 1. TAB Field Supervisor: Employee of the TAB specialist and certified by AABC.
 - 2. TAB Technician: Employee of the TAB specialist and certified by AABC as a TAB technician.
- B. TAB Specialists Qualifications: Certified by NEBB or TABB.
 - 1. TAB Field Supervisor: Employee of the TAB specialist and certified by NEBB or TABB.
 - 2. TAB Technician: Employee of the TAB specialist and certified by NEBB or TABB as a TAB technician.
- C. Instrumentation Type, Quantity, Accuracy, and Calibration: Comply with requirements in ASHRAE 111, Section 4, "Instrumentation."
- D. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6.7.2.3 - "System Balancing."

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems designs that may preclude proper TAB of systems and equipment.
- B. Examine installed systems for balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are applicable for intended purpose and are accessible.
- C. Examine the approved submittals for HVAC systems and equipment.
- D. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems output, and statements of philosophies and assumptions about HVAC system and equipment controls.

- E. Examine ceiling plenums and underfloor air plenums used for supply, return, or relief air to verify that they are properly separated from adjacent areas. Verify that penetrations in plenum walls are sealed and fire-stopped if required.
- F. Examine equipment performance data including fan and pump curves.
 - 1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
 - 2. Calculate system-effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," or in SMACNA's "HVAC Systems - Duct Design." Compare results with the design data and installed conditions.
- G. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.
- H. Examine test reports specified in individual system and equipment Sections.
- I. Examine HVAC equipment and verify that bearings are greased, belts are aligned and tight, filters are clean, and equipment with functioning controls is ready for operation.
- J. Examine terminal units, such as variable-air-volume boxes, and verify that they are accessible and their controls are connected and functioning.
- K. Examine strainers. Verify that startup screens have been replaced by permanent screens with indicated perforations.
- L. Examine control valves for proper installation for their intended function of throttling, diverting, or mixing fluid flows.
- M. Examine heat-transfer coils for correct piping connections and for clean and straight fins.
- N. Examine system pumps to ensure absence of entrained air in the suction piping.
- O. Examine operating safety interlocks and controls on HVAC equipment.
- P. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.2 PREPARATION

- A. Prepare a TAB plan that includes strategies and step-by-step procedures for balancing the systems.
- B. Perform system-readiness checks of HVAC systems and equipment to verify system readiness for TAB work. Include, at a minimum, the following:
 - 1. Airside:

- a. Duct systems are complete with terminals installed.
- b. Fans are operating, free of vibration, and rotating in correct direction.
- c. Suitable access to balancing devices and equipment is provided.

2. Hydronics:

- a. Verify leakage and pressure tests on water distribution systems have been satisfactorily completed.
- b. Piping is complete with terminals installed.
- c. Water treatment is complete.
- d. Systems are flushed, filled, and air purged.
- e. Strainers are pulled and cleaned.
- f. Control valves are functioning per the sequence of operation.
- g. Shutoff and balance valves have been verified to be 100 percent open.
- h. Pumps are started and proper rotation is verified.
- i. Pump gage connections are installed directly at pump inlet and outlet flanges or in discharge and suction pipe prior to valves or strainers.
- j. Variable-frequency controllers' startup is complete and safeties are verified.
- k. Suitable access to balancing devices and equipment is provided.

3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

- A. Perform testing and balancing procedures on each system according to the procedures contained in NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" and in this Section.
- B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.
 - 1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.
 - 2. After testing and balancing, install test ports and duct access doors that comply with requirements in Section 233300 "Air Duct Accessories."
 - 3. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Section 230713 "Duct Insulation," Section 230716 "HVAC Equipment Insulation," and Section 230719 "HVAC Piping Insulation."
- 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.

3.4 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

- A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Cross-check the summation of required outlet volumes with required fan volumes.

July 11, 2018

- B. Prepare schematic diagrams of systems' "as-built" duct layouts.
- C. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.
- D. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.
- E. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
- F. Verify that motor starters are equipped with properly sized thermal protection.
- G. Check dampers for proper position to achieve desired airflow path.
- H. Check for airflow blockages.
- I. Check condensate drains for proper connections and functioning.
- J. Check for proper sealing of air-handling-unit components.
- K. Verify that air duct system is sealed as specified in Section 233113 "Metal Ducts."

3.5 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 artificial loading of filters at the time static pressures are measured.
 - 3. Review Record Documents to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.
 - 4. Obtain approval from Engineer for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in HVAC Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.

5. 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 occurs. 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 submain and branch duct volume dampers for specified airflow.
 3. Re-measure each submain 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 inlets and outlets airflow.
 3. Adjust each inlet and outlet for specified airflow.
 4. Re-measure each inlet and outlet after they have been adjusted.

3.6 GENERAL PROCEDURES FOR HYDRONIC SYSTEMS

- A. Prepare test reports for pumps, coils, and heat exchangers. Obtain approved submittals and manufacturer-recommended testing procedures. Crosscheck the summation of required coil and heat exchanger flow rates with pump design flow rate.
- B. Prepare schematic diagrams of systems' "as-built" piping layouts.
- C. In addition to requirements in "Preparation" Article, prepare hydronic systems for testing and balancing as follows:
 1. Check liquid level in expansion tank.
 2. Check highest vent for adequate pressure.
 3. Check flow-control valves for 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.

3.7 PROCEDURES FOR CONSTANT-FLOW HYDRONIC SYSTEMS

- A. Adjust pumps to deliver total design gpm.
 1. Measure total water flow.
 - a. Position valves for full flow through coils.
 - b. Measure flow by main flow meter, if installed.
 - c. If main flow meter is not installed, determine flow by pump TDH or exchanger pressure drop.
 2. Measure pump TDH as follows:

- a. Measure discharge pressure directly at the pump outlet flange or in discharge pipe prior to any valves.
 - b. Measure inlet pressure directly at the pump inlet flange or in suction pipe prior to any valves or strainers.
 - c. Convert pressure to head and correct for differences in gage heights.
 - d. Verify pump impeller size by measuring the TDH with the discharge valve closed. Note the point on manufacturer's pump curve at zero flow, and verify that the pump has the intended impeller size.
 - e. With valves open, read pump TDH. Adjust pump discharge valve until design water flow is achieved.
3. Monitor motor performance during procedures and do not operate motor in an overloaded condition.
- B. Adjust flow-measuring devices installed in mains and branches to design water flows.
1. Measure flow in main and branch pipes.
 2. Adjust main and branch balance valves for design flow.
 3. Re-measure each main and branch after all have been adjusted.
- C. Adjust flow-measuring devices installed at terminals for each space to design water flows.
1. Measure flow at terminals.
 2. Adjust each terminal to design flow.
 3. Re-measure each terminal after it is adjusted.
 4. Position control valves to bypass the coil, and adjust the bypass valve to maintain design flow.
 5. Perform temperature tests after flows have been balanced.
- D. For systems with pressure-independent valves at terminals:
1. Measure differential pressure and verify that it is within manufacturer's specified range.
 2. Perform temperature tests after flows have been verified.
- E. For systems without pressure-independent valves or flow-measuring devices at terminals:
1. Measure and balance coils by either coil pressure drop or temperature method.
 2. If balanced by coil pressure drop, perform temperature tests after flows have been verified.
- F. Verify final system conditions as follows:
1. Re-measure and confirm that total water flow is within design.
 2. Re-measure final pumps' operating data, TDH, volts, amps, and static profile.
 3. Mark final settings.
- G. Verify that memory stops have been set.

3.8 PROCEDURES FOR VARIABLE-FLOW HYDRONIC SYSTEMS

- A. Balance systems with automatic two- and three-way control valves by setting systems at maximum flow through heat-exchange terminals, and proceed as specified above for hydronic systems.
- B. Adjust the variable-flow hydronic system as follows:
 - 1. Verify that the differential-pressure sensor is located as indicated.
 - 2. Determine whether there is diversity in the system.
- C. For systems with no diversity:
 - 1. Adjust pumps to deliver total design gpm.
 - a. Measure total water flow.
 - 1) Position valves for full flow through coils.
 - 2) Measure flow by main flow meter, if installed.
 - 3) If main flow meter is not installed, determine flow by pump TDH or exchanger pressure drop.
 - b. Measure pump TDH as follows:
 - 1) Measure discharge pressure directly at the pump outlet flange or in discharge pipe prior to any valves.
 - 2) Measure inlet pressure directly at the pump inlet flange or in suction pipe prior to any valves or strainers.
 - 3) Convert pressure to head and correct for differences in gage heights.
 - 4) Verify pump impeller size by measuring the TDH with the discharge valve closed. Note the point on manufacturer's pump curve at zero flow and verify that the pump has the intended impeller size.
 - 5) With valves open, read pump TDH. Adjust pump discharge valve until design water flow is achieved.
 - c. Monitor motor performance during procedures and do not operate motor in an overloaded condition.
 - 2. Adjust flow-measuring devices installed in mains and branches to design water flows.
 - a. Measure flow in main and branch pipes.
 - b. Adjust main and branch balance valves for design flow.
 - c. Re-measure each main and branch after all have been adjusted.
 - 3. Adjust flow-measuring devices installed at terminals for each space to design water flows.
 - a. Measure flow at terminals.
 - b. Adjust each terminal to design flow.
 - c. Re-measure each terminal after it is adjusted.
 - d. Position control valves to bypass the coil and adjust the bypass valve to maintain design flow.
 - e. Perform temperature tests after flows have been balanced.

4. For systems with pressure-independent valves at terminals:
 - a. Measure differential pressure and verify that it is within manufacturer's specified range.
 - b. Perform temperature tests after flows have been verified.
 5. For systems without pressure-independent valves or flow-measuring devices at terminals:
 - a. Measure and balance coils by either coil pressure drop or temperature method.
 - b. If balanced by coil pressure drop, perform temperature tests after flows have been verified.
 6. Prior to verifying final system conditions, determine the system differential-pressure set point.
 7. If the pump discharge valve was used to set total system flow with variable-frequency controller at 60 Hz, at completion open discharge valve 100 percent and allow variable-frequency controller to control system differential-pressure set point. Record pump data under both conditions.
 8. Mark final settings and verify that all memory stops have been set.
 9. Verify final system conditions as follows:
 - a. Re-measure and confirm that total water flow is within design.
 - b. Re-measure final pumps' operating data, TDH, volts, amps, and static profile.
 - c. Mark final settings.
 10. Verify that memory stops have been set.
- D. For systems with diversity:
1. Determine diversity factor.
 2. Simulate system diversity by closing required number of control valves, as approved by the design engineer.
 3. Adjust pumps to deliver total design gpm.
 - a. Measure total water flow.
 - 1) Position valves for full flow through coils.
 - 2) Measure flow by main flow meter, if installed.
 - 3) If main flow meter is not installed, determine flow by pump TDH or exchanger pressure drop.
 - b. Measure pump TDH as follows:
 - 1) Measure discharge pressure directly at the pump outlet flange or in discharge pipe prior to any valves.
 - 2) Measure inlet pressure directly at the pump inlet flange or in suction pipe prior to any valves or strainers.
 - 3) Convert pressure to head and correct for differences in gage heights.
 - 4) Verify pump impeller size by measuring the TDH with the discharge valve closed. Note the point on manufacturer's pump curve at zero flow and verify that the pump has the intended impeller size.

- 5) With valves open, read pump TDH. Adjust pump discharge valve until design water flow is achieved.
 - c. Monitor motor performance during procedures and do not operate motor in an overloaded condition.
4. Adjust flow-measuring devices installed in mains and branches to design water flows.
 - a. Measure flow in main and branch pipes.
 - b. Adjust main and branch balance valves for design flow.
 - c. Re-measure each main and branch after all have been adjusted.
5. Adjust flow-measuring devices installed at terminals for each space to design water flows.
 - a. Measure flow at terminals.
 - b. Adjust each terminal to design flow.
 - c. Re-measure each terminal after it is adjusted.
 - d. Position control valves to bypass the coil, and adjust the bypass valve to maintain design flow.
 - e. Perform temperature tests after flows have been balanced.
6. For systems with pressure-independent valves at terminals:
 - a. Measure differential pressure, and verify that it is within manufacturer's specified range.
 - b. Perform temperature tests after flows have been verified.
7. For systems without pressure-independent valves or flow-measuring devices at terminals:
 - a. Measure and balance coils by either coil pressure drop or temperature method.
 - b. If balanced by coil pressure drop, perform temperature tests after flows have been verified.
8. Open control valves that were shut. Close a sufficient number of control valves that were previously open to maintain diversity, and balance terminals that were just opened.
9. Prior to verifying final system conditions, determine system differential-pressure set point.
10. If the pump discharge valve was used to set total system flow with variable-frequency controller at 60 Hz, at completion open discharge valve 100 percent and allow variable-frequency controller to control system differential-pressure set point. Record pump data under both conditions.
11. Mark final settings and verify that memory stops have been set.
12. Verify final system conditions as follows:
 - a. Re-measure and confirm that total water flow is within design.
 - b. Re-measure final pumps' operating data, TDH, volts, amps, and static profile.
 - c. Mark final settings.
13. Verify that memory stops have been set.

3.9 TOLERANCES

- A. Set HVAC system's airflow 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.
 - 3. Heating-Water Flow Rate: Plus or minus 10 percent.
- B. Maintaining pressure relationships as designed shall have priority over the tolerances specified above.

3.10 FINAL REPORT

- A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.
 - 1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
 - 2. Include a list of instruments used for procedures, along with proof of calibration.
 - 3. Certify validity and accuracy of field data.
- B. Final Report Contents: In addition to certified field-report data, include the following:
 - 1. Pump curves.
 - 2. Fan curves.
 - 3. Manufacturers' test data.
 - 4. Field test reports prepared by system and equipment installers.
 - 5. Other information relative to equipment performance; do not include Shop Drawings and Product Data.
- C. General Report Data: In addition to form titles and entries, include the following data:
 - 1. Title page.
 - 2. Name and address of the TAB specialist.
 - 3. Project name.
 - 4. Project location.
 - 5. Architect's name and address.
 - 6. Engineer's name and address.
 - 7. Contractor's name and address.
 - 8. Report date.
 - 9. Signature of TAB supervisor who certifies the report.
 - 10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
 - 11. Summary of contents including the following:
 - a. Indicated versus final performance.
 - b. Notable characteristics of systems.
 - c. Description of system operation sequence if it varies from the Contract Documents.
 - 12. Nomenclature sheets for each item of equipment.
 - 13. Data for terminal units, including manufacturer's name, type, size, and fittings.

14. Notes to explain why certain final data in the body of reports vary from indicated values.
 15. Test conditions for fans and pump performance forms including the following:
 - a. Settings for outdoor-, return-, and exhaust-air dampers.
 - b. Conditions of filters.
 - c. Cooling coil, wet- and dry-bulb conditions.
 - d. Face and bypass damper settings at coils.
 - e. Fan drive settings including settings and percentage of maximum pitch diameter.
 - f. Inlet vane settings for variable-air-volume systems.
 - g. Settings for supply-air, static-pressure controller.
 - h. Other system operating conditions that affect performance.
- D. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:
1. Quantities of outdoor, supply, return, and exhaust airflows.
 2. Water and steam flow rates.
 3. Duct, outlet, and inlet sizes.
 4. Pipe and valve sizes and locations.
 5. Terminal units.
 6. Balancing stations.
 7. Position of balancing devices.
- E. Air-Handling-Unit Test Reports: For air-handling units with coils, include the following:
1. Unit Data:
 - a. Unit identification.
 - b. Location.
 - c. Make and type.
 - d. Model number and unit size.
 - e. Manufacturer's serial number.
 - f. Unit arrangement and class.
 - g. Discharge arrangement.
 - h. Sheave make, size in inches, and bore.
 - i. Center-to-center dimensions of sheave and amount of adjustments in inches.
 - j. Number, make, and size of belts.
 - k. Number, type, and size of filters.
 2. Motor Data:
 - a. Motor make, and frame type and size.
 - b. Horsepower and rpm.
 - c. Volts, phase, and hertz.
 - d. Full-load amperage and service factor.
 - e. Sheave make, size in inches, and bore.
 - f. Center-to-center dimensions of sheave and amount of adjustments in inches.
 3. Test Data (Indicated and Actual Values):
 - a. Total airflow rate in cfm.
 - b. Total system static pressure in inches wg.

- c. Fan rpm.
- d. Discharge static pressure in inches wg.
- e. Filter static-pressure differential in inches wg.
- f. Preheat-coil static-pressure differential in inches wg.
- g. Cooling-coil static-pressure differential in inches wg.
- h. Heating-coil static-pressure differential in inches wg.
- i. Outdoor airflow in cfm.
- j. Return airflow in cfm.
- k. Outdoor-air damper position.
- l. Return-air damper position.
- m. Vortex damper position.

F. Apparatus-Coil Test Reports:

1. Coil Data:

- a. System identification.
- b. Location.
- c. Coil type.
- d. Number of rows.
- e. Fin spacing in fins per inch o.c.
- f. Make and model number.
- g. Face area in sq. ft..
- h. Tube size in NPS.
- i. Tube and fin materials.
- j. Circuiting arrangement.

2. Test Data (Indicated and Actual Values):

- a. Airflow rate in cfm.
- b. Average face velocity in fpm.
- c. Air pressure drop in inches wg.
- d. Outdoor-air, wet- and dry-bulb temperatures in deg F.
- e. Return-air, wet- and dry-bulb temperatures in deg F.
- f. Entering-air, wet- and dry-bulb temperatures in deg F.
- g. Leaving-air, wet- and dry-bulb temperatures in deg F.
- h. Water flow rate in gpm.
- i. Water pressure differential in feet of head or psig.
- j. Entering-water temperature in deg F.
- k. Leaving-water temperature in deg F.
- l. Refrigerant expansion valve and refrigerant types.
- m. Refrigerant suction pressure in psig.
- n. Refrigerant suction temperature in deg F.
- o. Inlet steam pressure in psig.
- p.

G. Fan Test Reports: For supply, return, and exhaust fans, include the following:

1. Fan Data:

- a. System identification.
- b. Location.

- c. Make and type.
 - d. Model number and size.
 - e. Manufacturer's serial number.
 - f. Arrangement and class.
 - g. Sheave make, size in inches, and bore.
 - h. Center-to-center dimensions of sheave and amount of adjustments in inches.
 - 2. Motor Data:
 - a. Motor make, and frame type and size.
 - b. Horsepower and rpm.
 - c. Volts, phase, and hertz.
 - d. Full-load amperage and service factor.
 - e. Sheave make, size in inches, and bore.
 - f. Center-to-center dimensions of sheave, and amount of adjustments in inches.
 - g. Number, make, and size of belts.
 - 3. Test Data (Indicated and Actual Values):
 - a. Total airflow rate in cfm.
 - b. Total system static pressure in inches wg.
 - c. Fan rpm.
 - d. Discharge static pressure in inches wg.
 - e. Suction static pressure in inches wg.
- H. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:
 - 1. Report Data:
 - a. System and air-handling-unit number.
 - b. Location and zone.
 - c. Traverse air temperature in deg F.
 - d. Duct static pressure in inches wg.
 - e. Duct size in inches.
 - f. Duct area in sq. ft..
 - g. Indicated airflow rate in cfm.
 - h. Indicated velocity in fpm.
 - i. Actual airflow rate in cfm.
 - j. Actual average velocity in fpm.
 - k. Barometric pressure in psig.
- I. Pump Test Reports: Calculate impeller size by plotting the shutoff head on pump curves and include the following:
 - 1. Unit Data:
 - a. Unit identification.
 - b. Location.
 - c. Service.
 - d. Make and size.
 - e. Model number and serial number.

- f. Water flow rate in gpm.
- g. Water pressure differential in feet of head or psig.
- h. Required net positive suction head in feet of head or psig.
- i. Pump rpm.
- j. Impeller diameter in inches.
- k. Motor make and frame size.
- l. Motor horsepower and rpm.
- m. Voltage at each connection.
- n. Amperage for each phase.
- o. Full-load amperage and service factor.
- p. Seal type.

2. Test Data (Indicated and Actual Values):

- a. Static head in feet of head or psig.
- b. Pump shutoff pressure in feet of head or psig.
- c. Actual impeller size in inches.
- d. Full-open flow rate in gpm.
- e. Full-open pressure in feet of head or psig.
- f. Final discharge pressure in feet of head or psig.
- g. Final suction pressure in feet of head or psig.
- h. Final total pressure in feet of head or psig.
- i. Final water flow rate in gpm.
- j. Voltage at each connection.
- k. Amperage for each phase.

J. Instrument Calibration Reports:

1. Report Data:

- a. Instrument type and make.
- b. Serial number.
- c. Application.
- d. Dates of use.
- e. Dates of calibration.

3.11 VERIFICATION OF TAB REPORT

- A. The TAB specialist's test and balance engineer shall conduct the inspection in the presence of Construction Manager.
- B. Construction Manager 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.
- C. 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."
- D. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.

- E. If TAB work fails, proceed as follows:
 - 1. TAB specialists shall recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection.
 - 2. If the second final inspection also fails, Owner may contract the services of another TAB specialist to complete TAB work according to the Contract Documents and deduct the cost of the services from the original TAB specialist's final payment.
 - 3. If the second verification also fails, design professional may contact AABC Headquarters regarding the AABC National Performance Guaranty.

- F. Prepare test and inspection reports.

3.12 ADDITIONAL TESTS

- A. Within 90 days of completing TAB, perform additional TAB to verify that balanced conditions are being maintained throughout and to correct unusual conditions.

- B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional TAB during near-peak summer and winter conditions.

END OF SECTION

SECTION 230716

HVAC EQUIPMENT INSULATION
(FILED SUB-BID REQUIRED AS PART OF SECTION 23 00 01)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Sub-Bid Requirements: As provided under Section 23 00 01 – Heating, Ventilating and Air Conditioning Filed Sub-Bid Requirements and supplemented under the Bidding Requirements, Contract Forms, and Conditions of the Contract, and applicable parts of Division 1 - General Requirements.
 - 1. Work of this Filed Sub-Bid includes all individual specification sections listed in Section 23 00 01.

1.2 SUMMARY

- A. Section includes insulating the following HVAC equipment that is not factory insulated:
 - 1. Heating, hot-water pumps.
 - 2. Expansion/compression tanks.
 - 3. Air separators.
- B. Related Sections:
 - 1. Section 230719 "HVAC Piping Insulation."

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - 1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
 - 2. Detail attachment and covering of heat tracing inside insulation.
 - 3. Detail removable insulation at equipment connections.
 - 4. Detail application of field-applied jackets.
 - 5. Detail application at linkages of control devices.
 - 6. Detail field application for each equipment type.
- C. Field quality-control reports.

July 11, 2018

1.4 QUALITY ASSURANCE

- A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing 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.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

- A. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- B. 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.
- C. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- D. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- E. 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. Factory fabricate shapes according to ASTM C 450 and ASTM C 585.
- F. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials.
- G. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type III with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
- H. High-Temperature, Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type V, without factory-applied jacket.
- I. Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IA or Type IB. Provide insulation with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

July 11, 2018

- J. High-Temperature, Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type III, without factory-applied jacket.
- K. Mineral-Fiber, Pipe and Tank Insulation: Mineral or glass fibers bonded with a thermosetting resin. Semirigid board material with factory-applied 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 or less. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
- L. Polyolefin: Unicellular, polyethylene thermal plastic insulation. Comply with ASTM C 534 or ASTM C 1427, Type I, Grade 1 for tubular materials and Type II, Grade 1 for sheet materials.
- M. Polystyrene: Rigid, extruded cellular polystyrene intended for use as thermal insulation. Comply with ASTM C 578, Type IV or Type XIII, except thermal conductivity (k-value) shall not exceed 0.26 Btu x in./h x sq. ft. x deg F after 180 days of aging. Fabricate shapes according to ASTM C 450 and ASTM C 585.

2.2 INSULATING CEMENTS

- A. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449.

2.3 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.
- C. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.
- D. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
- E. Polystyrene Adhesive: Solvent- or water-based, synthetic resin adhesive with a service temperature range of minus 20 to plus 140 deg F.
- F. 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.
- G. PVC Jacket Adhesive: Compatible with PVC jacket.

2.4 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.
- B. Vapor-Barrier Mastic: Water based; suitable for indoor and outdoor use on below ambient services.

1. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.
2. Service Temperature Range: Minus 20 to plus 180 deg F.
3. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
4. Color: White.

C. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.

1. Water-Vapor Permeance: ASTM F 1249, 1.8 perms at 0.0625-inch dry film thickness.
2. Service Temperature Range: Minus 20 to plus 180 deg F.
3. Solids Content: 60 percent by volume and 66 percent by weight.
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.
4. Color: White or gray.

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.
4. Color: Aluminum.

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.
4. Color: White.

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.

July 11, 2018

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. PVDC Jacket for Indoor Applications: 4-mil-thick, white PVDC biaxially oriented barrier film with a permeance at 0.02 perm when tested according to ASTM E 96/E 96M and with a flame-spread index of 5 and a smoke-developed index of 20 when tested according to ASTM E 84.
6. PVDC Jacket for Outdoor Applications: 6-mil-thick, white PVDC biaxially oriented barrier film with a permeance at 0.01 perm when tested according to ASTM E 96/E 96M and with a flame-spread index of 5 and a smoke-developed index of 25 when tested according to ASTM E 84.
7. PVDC-SSL Jacket: PVDC jacket with a self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip.
8. Vinyl Jacket: White vinyl with a permeance of 1.3 perms when tested according to ASTM E 96/E 96M, Procedure A, and complying with NFPA 90A and NFPA 90B.

2.7 FIELD-APPLIED FABRIC-REINFORCING MESH

- A. Woven Polyester Fabric: Approximately 1 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. in., in a Leno weave, for equipment.

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. Adhesive: As recommended by jacket material manufacturer.
 2. Color: White.
 3. Factory-fabricated tank heads and tank side panels.
- D. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105, or 5005, Temper H-14.
 1. Sheet and roll stock ready for shop or field sizing.
 2. Finish and thickness are indicated in field-applied jacket schedules.
 3. Moisture Barrier for Indoor Applications: 3-mil-thick, heat-bonded polyethylene and kraft paper.

July 11, 2018

4. Moisture Barrier for Outdoor Applications: 3-mil-thick, heat-bonded polyethylene and kraft paper.
5. Factory-Fabricated Fitting Covers:
 - a. Same material, finish, and thickness as jacket.
 - b. Preformed two-piece or gore, 45- and 90-degree, short- and long-radius elbows.
 - c. Tee covers.
 - d. Flange and union covers.
 - e. End caps.
 - f. Beveled collars.
 - g. Valve covers.
 - h. Field fabricate fitting covers only if factory-fabricated fitting covers are not available.
- E. Self-Adhesive Outdoor Jacket: 60-mil-thick, laminated vapor barrier and waterproofing membrane for installation over insulation located aboveground outdoors; consisting of a rubberized bituminous resin on a crosslaminated polyethylene film covered with white aluminum-foil facing.
- F. PVDC Jacket for Indoor Applications: 4-mil-thick, white PVDC biaxially oriented barrier film with a permeance at 0.02 perm when tested according to ASTM E 96/E 96M and with a flame-spread index of 5 and a smoke-developed index of 20 when tested according to ASTM E 84.
- G. PVDC Jacket for Outdoor Applications: 6-mil-thick, white PVDC biaxially oriented barrier film with a permeance at 0.01 perm when tested according to ASTM E 96/E 96M and with a flame-spread index of 5 and a smoke-developed index of 25 when tested according to ASTM E 84.
- H. 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.
 1. Width: 3 inches.
 2. Thickness: 11.5 mils.
 3. Adhesion: 90 ounces force/inch in width.
 4. Elongation: 2 percent.
 5. Tensile Strength: 40 lbf/inch 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.
 2. Thickness: 6.5 mils.
 3. Adhesion: 90 ounces force/inch in width.
 4. Elongation: 2 percent.
 5. Tensile Strength: 40 lbf/inch in width.
 6. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

July 11, 2018

- 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.
 - 2. Thickness: 6 mils.
 - 3. Adhesion: 64 ounces force/inch in width.
 - 4. Elongation: 500 percent.
 - 5. Tensile Strength: 18 lbf/inch in width.

- D. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.
 - 1. Width: 2 inches.
 - 2. Thickness: 3.7 mils.
 - 3. Adhesion: 100 ounces force/inch in width.
 - 4. Elongation: 5 percent.
 - 5. Tensile Strength: 34 lbf/inch in width.

- E. PVDC Tape for Indoor Applications: White vapor-retarder PVDC tape with acrylic adhesive.
 - 1. Width: 3 inches.
 - 2. Film Thickness: 4 mils.
 - 3. Adhesive Thickness: 1.5 mils.
 - 4. Elongation at Break: 145 percent.
 - 5. Tensile Strength: 55 lbf/inch in width.

- F. PVDC Tape for Outdoor Applications: White vapor-retarder PVDC tape with acrylic adhesive.
 - 1. Width: 3 inches.
 - 2. Film Thickness: 6 mils.
 - 3. Adhesive Thickness: 1.5 mils.
 - 4. Elongation at Break: 145 percent.
 - 5. Tensile Strength: 55 lbf/inch in width.

2.10 SECUREMENTS

- A. Aluminum Bands: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide with wing seal.

- B. Insulation Pins and Hangers:
 - 1. 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.
 - a. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.

- b. Spindle: Stainless steel, fully annealed, 0.106-inch-diameter shank, length to suit depth of insulation indicated.
 - c. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.
 2. Nonmetal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate fastened to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place.
 - a. Baseplate: Perforated, nylon sheet, 0.030 inch thick by 1-1/2 inches in diameter.
 - b. Spindle: Nylon, 0.106-inch-diameter shank, length to suit depth of insulation indicated, up to 2-1/2 inches.
 - c. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.
 3. Self-Sticking-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.
 - a. Baseplate: Galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
 - b. Spindle: Stainless steel, fully annealed, 0.106-inch-diameter shank, length to suit depth of insulation indicated.
 - c. Adhesive-backed base with a peel-off protective cover.
 4. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick, stainless-steel sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.
 - a. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.
 5. Nonmetal Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick nylon sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.
- C. Staples: Outward-clinching insulation staples, nominal 3/4-inch-wide, stainless steel or Monel.
- D. Wire: 0.062-inch soft-annealed, stainless steel.

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, Alloy 3003, 3005, 3105, or 5005; Temper H-14.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
- B. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.
- C. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.2 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment 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. Keep insulation materials dry during application and finishing.
- G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- H. Install insulation with least number of joints practical.
- I. 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 insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

July 11, 2018

- J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- K. 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. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 4 inches 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.
- L. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- N. 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.
- O. 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.

3.3 INSTALLATION OF EQUIPMENT, TANK, AND VESSEL INSULATION

- A. Mineral-Fiber, Pipe and Tank Insulation Installation for Tanks and Vessels: 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 overcompress 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.
- B. Flexible Elastomeric Thermal Insulation Installation for Tanks and Vessels: Install insulation over entire surface of tanks and vessels.
1. Apply 100 percent coverage of adhesive to surface with manufacturer's recommended adhesive.
 2. Seal longitudinal seams and end joints.
- C. Insulation Installation on Pumps:
1. Fabricate metal boxes lined with insulation. Fit boxes around pumps and coincide box joints with splits in pump casings. Fabricate joints with outward bolted flanges. Bolt flanges on 6-inch centers, starting at corners. Install 3/8-inch-diameter fasteners with wing nuts. Alternatively, secure the box sections together using a latching mechanism.
 2. Fabricate boxes from stainless steel, at least 0.050 inch thick.
 3. For below ambient services, install a vapor barrier at seams, joints, and penetrations. Seal between flanges with replaceable gasket material to form a vapor barrier.

July 11, 2018

3.4 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 PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications, install with longitudinal seams along top and bottom of tanks and vessels. 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.
- C. 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.
- D. Where PVDC jackets are indicated, install as follows:
1. Jacket can be wrapped in cigarette fashion along length of roll for insulation systems with an outer circumference of 33-1/2 inches or less. 33-1/2-inch-circumference limit allows for 2-inch-overlap seal. Using the length of roll allows for longer sections of jacket to be installed at one time. Use adhesive on the lap seal. Visually inspect lap seal for "fishmouthing," and use PVDC tape along lap seal to secure joint.
 2. Repair holes or tears in PVDC jacket by placing PVDC tape over the hole or tear and wrapping a minimum of 1-1/4 circumferences to avoid damage to tape edges.

3.5 FINISHES

- A. Equipment Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint.
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.

July 11, 2018

3.6 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections: Inspect field-insulated equipment, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to one location(s) for each type of equipment defined in the "Equipment Insulation Schedule" Article. For large equipment, remove only a portion adequate to determine compliance.
- C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.7 BREECHING INSULATION SCHEDULE

- A. Round, Exposed Breeching and Connector: High-temperature mineral-fiber blanket, 3 inches thick and 3-lb/cu. ft. nominal density.
- B. Round, Concealed Breeching and Connector Insulation: High-temperature mineral-fiber blanket, 3 inches thick and 3-lb/cu. ft. nominal density.

3.8 EQUIPMENT INSULATION SCHEDULE

- A. Insulation materials and thicknesses are identified below. If more than one material is listed for a type of equipment, selection from materials listed is Contractor's option.
- B. Insulate indoor and outdoor equipment that is not factory insulated.
- C. Heating-Hot-Water Pump Insulation: Mineral-Fiber Board: 2 inches thick and 3-lb/cu. ft. nominal density.
- D. Heating-Hot-Water Expansion/Compression Tank Insulation: Mineral-Fiber Pipe and Tank: 1 inch thick.
- E. Heating-Hot-Water Air-Separator Insulation: Mineral-Fiber Pipe and Tank: 2 inches thick.

3.9 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. Equipment, Concealed:
 - 1. None.
 - 2. PVC: 30 mils thick.
 - 3. Aluminum, Smooth: 0.024 inch thick.

July 11, 2018

POPE'S TAVERN
ADDITION/RENOVATION
Halifax, Massachusetts

- D. Equipment, Exposed, up to 48 Inches in Diameter or with Flat Surfaces up to 72 Inches:
1. None.
 2. PVC: 30 mils thick.
 3. Aluminum, Smooth: 0.024 inch thick.
- E. Equipment, Exposed, Larger Than 48 Inches in Diameter or with Flat Surfaces Larger Than 72 Inches:
1. None.
 2. Painted Aluminum, Smooth with 1-1/4-Inch-Deep Corrugations: 0.032 inch thick.

END OF SECTION

SECTION 230719

HVAC PIPING INSULATION
(FILED SUB-BID REQUIRED AS PART OF SECTION 23 00 01)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Sub-Bid Requirements: As provided under Section 23 00 01 – Heating, Ventilating and Air Conditioning Filed Sub-Bid Requirements and supplemented under the Bidding Requirements, Contract Forms, and Conditions of the Contract, and applicable parts of Division 1 - General Requirements.
 - 1. Work of this Filed Sub-Bid includes all individual specification sections listed in Section 23 00 01.

1.2 SUMMARY

- A. Section includes insulating the following HVAC piping systems:

- 1. Heating hot-water piping, indoors.

- B. Related Sections:

- 1. Section 230716 "HVAC Equipment Insulation."

1.3 SUBMITTALS

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

- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

- 1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
 - 2. Detail attachment and covering of heat tracing inside insulation.
 - 3. Detail insulation application at pipe expansion joints for each type of insulation.
 - 4. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
 - 5. Detail removable insulation at piping specialties.
 - 6. Detail application of field-applied jackets.
 - 7. Detail application at linkages of control devices.

- C. Field quality-control reports.

1.4 QUALITY ASSURANCE

- A. 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.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

- A. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- B. 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.
- C. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- D. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- E. 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 or ASJ-SSL: Comply with ASTM C 552, Type II, Class 2.
 - 6. Factory fabricate shapes according to ASTM C 450 and ASTM C 585.
- F. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 1290, Type I.
- G. Mineral-Fiber, Preformed Pipe Insulation:
 - 1. 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 "Factory-Applied Jackets" Article.

July 11, 2018

- 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.
- I. Polyolefin: Unicellular, polyethylene thermal plastic insulation. Comply with ASTM C 534 or ASTM C 1427, Type I, Grade 1 for tubular materials and Type II, Grade 1 for sheet materials.

2.2 INSULATING CEMENTS

- A. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449.

2.3 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.
- C. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
- D. 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.
- E. PVC Jacket Adhesive: Compatible with PVC jacket.

2.4 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.
- 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 at 43-mil dry film thickness.
 - 2. Service Temperature Range: Minus 20 to plus 180 deg F.
 - 3. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
 - 4. Color: White.
- C. Breather Mastic: Water based; suitable for indoor and outdoor use on above-ambient services.
 - 1. Water-Vapor Permeance: ASTM F 1249, 1.8 perms at 0.0625-inch dry film thickness.

2. Service Temperature Range: Minus 20 to plus 180 deg F.
3. Solids Content: 60 percent by volume and 66 percent by weight.
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.
4. Color: White or gray.

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.
4. Color: Aluminum.

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.
4. Color: White.

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. PVDC Jacket for Indoor Applications: 4-mil-thick, white PVDC biaxially oriented barrier film with a permeance at 0.02 perm when tested according to ASTM E 96/E 96M and with a flame-spread index of 5 and a smoke-developed index of 20 when tested according to ASTM E 84.

July 11, 2018

6. PVDC Jacket for Outdoor Applications: 6-mil-thick, white PVDC biaxially oriented barrier film with a permeance at 0.01 perm when tested according to ASTM E 96/E 96M and with a flame-spread index of 5 and a smoke-developed index of 25 when tested according to ASTM E 84.
7. PVDC-SSL Jacket: PVDC jacket with a self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip.
8. Vinyl Jacket: White vinyl with a permeance of 1.3 perms when tested according to ASTM E 96/E 96M, Procedure A, and complying with NFPA 90A and NFPA 90B.

2.7 FIELD-APPLIED FABRIC-REINFORCING MESH

- A. Woven Polyester Fabric: Approximately 1 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. in., in a Leno weave, for pipe.

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. Adhesive: As recommended by jacket material manufacturer.
 2. Color: White.
 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.
- D. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105, or 5005, Temper H-14.
 1. Sheet and roll stock ready for shop or field sizing.
 2. Finish and thickness are indicated in field-applied jacket schedules.
 3. Moisture Barrier for Indoor Applications: 3-mil-thick, heat-bonded polyethylene and kraft paper.
 4. Factory-Fabricated Fitting Covers:
 - a. Same material, finish, and thickness as jacket.
 - b. Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
 - c. Tee covers.
 - d. Flange and union covers.
 - e. End caps.
 - f. Beveled collars.

- g. Valve covers.
 - h. Field fabricate fitting covers only if factory-fabricated fitting covers are not available.
 - E. PVDC Jacket for Indoor Applications: 4-mil-thick, white PVDC biaxially oriented barrier film with a permeance at 0.02 perms when tested according to ASTM E 96/E 96M and with a flame-spread index of 5 and a smoke-developed index of 20 when tested according to ASTM E 84.
 - F. 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.
 - 1. Width: 3 inches.
 - 2. Thickness: 11.5 mils.
 - 3. Adhesion: 90 ounces force/inch in width.
 - 4. Elongation: 2 percent.
 - 5. Tensile Strength: 40 lbf/inch 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.
 - 2. Thickness: 6.5 mils.
 - 3. Adhesion: 90 ounces force/inch in width.
 - 4. Elongation: 2 percent.
 - 5. Tensile Strength: 40 lbf/inch 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.
 - 2. Thickness: 6 mils.
 - 3. Adhesion: 64 ounces force/inch in width.
 - 4. Elongation: 500 percent.
 - 5. Tensile Strength: 18 lbf/inch in width.
 - D. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.
 - 1. Width: 2 inches.
 - 2. Thickness: 3.7 mils.
 - 3. Adhesion: 100 ounces force/inch in width.
 - 4. Elongation: 5 percent.
-

5. Tensile Strength: 34 lbf/inch in width.
- E. PVDC Tape for Indoor Applications: White vapor-retarder PVDC tape with acrylic adhesive.
1. Width: 3 inches.
 2. Film Thickness: 4 mils.
 3. Adhesive Thickness: 1.5 mils.
 4. Elongation at Break: 145 percent.
 5. Tensile Strength: 55 lbf/inch in width.

2.10 SECUREMENTS

- A. Aluminum Bands: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide with wing seal.
- B. Staples: Outward-clinching insulation staples, nominal 3/4-inch-wide, stainless steel or Monel.
- C. Wire: 0.062-inch soft-annealed, stainless steel.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
- B. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.
- C. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.2 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-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 4 inches 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 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.

3.3 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 Underground 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.
- F. Insulation Installation at Floor Penetrations:

1. Pipe: Install insulation continuously through floor penetrations.

3.4 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.

July 11, 2018

- 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.

3.5 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 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, 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.

3.6 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

- A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:

1. Install 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 sheet insulation of same thickness as pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed valve covers manufactured of same material as pipe insulation when available.
2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. 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.
4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.7 INSTALLATION OF MINERAL-FIBER PREFORMED PIPE 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 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, 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 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.

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- B. Where PVC jackets are indicated, install with 1-inch 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.
 - C. 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.
 - D. Where PVDC jackets are indicated, install as follows:
 - 1. Apply three separate wraps of filament tape per insulation section to secure pipe insulation to pipe prior to installation of PVDC jacket.
 - 2. Wrap factory-presized jackets around individual pipe insulation sections with one end overlapping the previously installed sheet. Install presized jacket with an approximate overlap at butt joint of 2 inches over the previous section. Adhere lap seal using adhesive or SSL, and then apply 1-1/4 circumferences of appropriate PVDC tape around overlapped butt joint.
 - 3. Continuous jacket can be spiral-wrapped around a length of pipe insulation. Apply adhesive or PVDC tape at overlapped spiral edge. When electing to use adhesives, refer to manufacturer's written instructions for application of adhesives along this spiral edge to maintain a permanent bond.
 - 4. Jacket can be wrapped in cigarette fashion along length of roll for insulation systems with an outer circumference of 33-1/2 inches or less. The 33-1/2-inch-circumference limit allows for 2-inch-overlap seal. Using the length of roll allows for longer sections of jacket to be installed at one time. Use adhesive on the lap seal. Visually inspect lap seal for "fishmouthing," and use PVDC tape along lap seal to secure joint.
 - 5. Repair holes or tears in PVDC jacket by placing PVDC tape over the hole or tear and wrapping a minimum of 1-1/4 circumferences to avoid damage to tape edges.

3.9 FINISHES

- A. Pipe Insulation with ASJ or Other Paintable Jacket Material: Paint jacket with paint:
 - 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.

July 11, 2018

3.10 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
 - 1. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, 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.
- C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.11 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. Drainage piping located in crawl spaces.
 - 2. Underground piping.
 - 3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.12 INDOOR PIPING INSULATION SCHEDULE

- A. Heating-Hot-Water Supply and Return, 200 Deg F and Below: Insulation shall be one of the following:
 - 1. Cellular Glass: 1-1/2 inches thick.
 - 2. Mineral-Fiber, Preformed Pipe, Type I: 2 inches thick.

3.13 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, Concealed:
 - 1. None.
 - 2. PVC: 30 mils thick.

July 11, 2018

POPE'S TAVERN
ADDITION/RENOVATION
Halifax, Massachusetts

3. Aluminum, Smooth: 0.024 inch thick.

D. Piping, Exposed:

1. None.
2. PVC: 30 mils thick.
3. Aluminum, Smooth: 0.024 inch thick.

END OF SECTION

SECTION 232113

HYDRONIC PIPING
(FILED SUB-BID REQUIRED AS PART OF SECTION 23 00 01)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Sub-Bid Requirements: As provided under Section 23 00 01 – Heating, Ventilating and Air Conditioning Filed Sub-Bid Requirements and supplemented under the Bidding Requirements, Contract Forms, and Conditions of the Contract, and applicable parts of Division 1 - General Requirements.
 - 1. Work of this Filed Sub-Bid includes all individual specification sections listed in Section 23 00 01.

1.2 SUMMARY

- A. Section includes pipe and fitting materials and joining methods for the following:
 - 1. Steel pipe and fittings.
 - 2. Joining materials.
 - 3. Transition fittings.
 - 4. Dielectric fittings.

1.3 SUBMITTALS

- A. Product Data: For each type of the following:
 - 1. Pipe.
 - 2. Fittings.
 - 3. Joining materials.
- B. Field quality-control reports.

1.4 QUALITY ASSURANCE

- A. ASME Compliance: Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Hydronic piping components and installation shall be capable of withstanding the following minimum working pressure and temperature unless otherwise indicated:
 - 1. Hot-Water Heating Piping: 100 psig at 200 deg F
 - 2. Makeup-Water Piping: 150 psig at 150 deg F
 - 3. Air-Vent Piping: 180 deg F at 200 deg F
 - 4. Safety-Valve-Inlet and -Outlet Piping: Equal to the pressure of the piping system to which it is attached.

2.2 COPPER TUBE AND FITTINGS

- A. Drawn-Temper Copper Tubing: [ASTM B 88, Type L.
- B. Annealed-Temper Copper Tubing: ASTM B 88, Type K
- C. DWV Copper Tubing: ASTM B 306, Type DWV.
- D. Grooved, Mechanical-Joint, Wrought-Copper Fittings: ASME B16.22.
 - 1. Grooved-End Copper Fittings: ASTM B 75, copper tube or ASTM B 584, bronze casting.
 - 2. Grooved-End-Tube Couplings: Rigid pattern unless otherwise indicated; gasketed fitting. Ductile-iron housing with keys matching pipe and fitting grooves, EPDM gasket rated for minimum 230 deg F, for use with housing, and steel bolts and nuts.
- E. Wrought-Copper Unions: ASME B16.22.

2.3 STEEL PIPE AND FITTINGS

- A. Steel Pipe: ASTM A 53/A 53M, black steel with plain ends; welded and seamless, Grade B, and wall thickness as indicated in "Piping Applications" Article.
- B. Cast-Iron Threaded Fittings: ASME B16.4; Classes 125 and 250 as indicated in "Piping Applications" Article.
- C. Malleable-Iron Threaded Fittings: ASME B16.3, Classes 150 and 300 as indicated in "Piping Applications" Article.
- D. Malleable-Iron Unions: ASME B16.39; Classes 150, 250, and 300 as indicated in "Piping Applications" Article.
- E. Cast-Iron Pipe Flanges and Flanged Fittings: ASME B16.1, Classes 25, 125, and 250; raised ground face, and bolt holes spot faced as indicated in "Piping Applications" Article.
- F. Wrought Cast- and Forged-Steel Flanges and Flanged Fittings: ASME B16.5, including bolts, nuts, and gaskets of the following material group, end connections, and facings:

1. Material Group: 1.1.
2. End Connections: Butt welding.
3. Facings: Raised face.

G. Grooved Mechanical-Joint Fittings and Couplings:

1. Joint Fittings: ASTM A 536, Grade 65-45-12 ductile iron; ASTM A 47/A 47M, Grade 32510 malleable iron; ASTM A 53/A 53M, Type F, E, or S, Grade B fabricated steel; or ASTM A 106/A 106M, Grade B steel fittings with grooves or shoulders constructed to accept grooved-end couplings; with nuts, bolts, locking pin, locking toggle, or lugs to secure grooved pipe and fittings.
2. Couplings: Ductile- or malleable-iron housing and EPDM gasket of central cavity pressure-responsive design; with nuts, bolts, locking pin, locking toggle, or lugs to secure grooved pipe and fittings.

H. Plain-End Mechanical-Joint Couplings:

1. Housing: ASTM A-536 Grade 65-45-12 segmented ductile iron or type 304 stainless steel.
2. Gasket: EPDM
3. Sealing Mechanism: Double-lip sealing system or carbon steel case-hardened jaws.
4. Bolts, hex nuts, washers, or lock bars based on manufacturer's design.
5. Minimum Pressure Rating: Equal to that of the joined pipes.

2.4 JOINING MATERIALS

A. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

1. ASME B16.21, nonmetallic, flat, asbestos free, 1/8-inch maximum thickness unless otherwise indicated.
 - a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
 - b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.

B. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

C. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

D. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for joining copper with copper; or BAg-1, silver alloy for joining copper with bronze or steel.

E. Welding Filler Metals: Comply with AWS D10.12M/D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

2.5 TRANSITION FITTINGS

A. Plastic-to-Metal Transition Fittings:

1. One-piece fitting with one threaded brass or copper insert and one solvent-cement-joint end of material and wall thickness to match plastic pipe material.

B. Plastic-to-Metal Transition Unions:

1. Brass or copper end, solvent-cement-joint end of material and wall thickness to match plastic pipe material, rubber gasket, and threaded union.

2.6 DIELECTRIC FITTINGS

A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.

B. Dielectric Unions:

1. Description:
 - a. Standard: ASSE 1079.
 - b. Pressure Rating: 125 psig minimum at 180 deg F.
 - c. End Connections: Solder-joint copper alloy and threaded ferrous.

2.7 BYPASS CHEMICAL FEEDER

A. Description: Welded steel construction; 125-psig working pressure; 5-gal. capacity; with fill funnel and inlet, outlet, and drain valves.

1. Chemicals: Specially formulated, based on analysis of makeup water, to prevent accumulation of scale and corrosion in piping and connected equipment.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

A. Hot-water heating piping, aboveground, NPS 2 and smaller, shall be any of the following:

1. Type L drawn-temper copper tubing, wrought-copper fittings, and soldered or pressure-seal joints.
2. Schedule 40, Grade B steel pipe; Class 125, cast-iron fittings; cast-iron flanges and flange fittings; and threaded joints.

B. Makeup-water piping installed aboveground shall be either of the following:

1. [Type L, drawn-temper copper tubing, wrought-copper fittings, and soldered joints.
2. Schedule 80 CPVC plastic pipe and fittings, and solvent-welded joints.

C. Makeup-Water Piping Installed Belowground and within Slabs: Type K, annealed-temper copper tubing, wrought-copper fittings, and soldered joints. Use the fewest possible joints.

D. Condensate-Drain Piping: Type M, drawn-temper copper tubing, wrought-copper fittings, and soldered joints or Schedule 40 PVC plastic pipe and fittings and solvent-welded joints.

E. Condensate-Drain Piping: Schedule 40 PVC plastic pipe and fittings and solvent-welded joints.

July 11, 2018

- F. Blowdown-Drain Piping: Same materials and joining methods as for piping specified for the service in which blowdown drain is installed.
- G. Air-Vent Piping:
 - 1. Inlet: Same as service where installed with metal-to-plastic transition fittings for plastic piping systems according to piping manufacturer's written instructions.
 - 2. Outlet: Type K , annealed-temper copper tubing with soldered or flared joints.
- H. Safety-Valve-Inlet and -Outlet Piping for Hot-Water Piping: Same materials and joining methods as for piping specified for the service in which safety valve is installed with metal-to-plastic transition fittings for plastic piping systems according to piping manufacturer's written instructions.

3.2 PIPING INSTALLATIONS

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- 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 above accessible ceilings to allow sufficient space for ceiling panel removal.
- E. Install piping to permit valve servicing.
- 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 groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.
- L. Install drains, consisting of a tee fitting, NPS 3/4 ball valve, and short NPS 3/4 threaded nipple with cap, at low points in piping system mains and elsewhere as required for system drainage.
- M. Install piping at a uniform grade of 0.2 percent upward in direction of flow.
- N. Reduce pipe sizes using eccentric reducer fitting installed with level side up.

July 11, 2018

- O. Install branch connections to mains using tee fittings in main pipe, with the branch connected to the bottom of the main pipe. For up-feed risers, connect the branch to the top of the main pipe.
- P. Install valves according to the following:
 - 1. Section 230523.12 "Ball Valves for HVAC Piping."
 - 2. Section 230523.14 "Check Valves for HVAC Piping."
- Q. Install unions in piping, NPS 2 and smaller, adjacent to valves, at final connections of equipment, and elsewhere as indicated.
- R. Install shutoff valve immediately upstream of each dielectric fitting.
- S. Comply with requirements in Section 230516 "Expansion Fittings and Loops for HVAC Piping" for installation of expansion loops, expansion joints, anchors, and pipe alignment guides.
- T. Comply with requirements in Section 230553 "Identification for HVAC Piping and Equipment" for identifying piping.
- U. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 230517 "Sleeves and Sleeve Seals for HVAC Piping."
- V. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 230517 "Sleeves and Sleeve Seals for HVAC Piping."
- W. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 230518 "Escutcheons for HVAC Piping."

3.3 DIELECTRIC FITTING INSTALLATION

- A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
- B. Dielectric Fittings for NPS 2 and Smaller: Use dielectric unions.

3.4 HANGERS AND SUPPORTS

- A. Comply with requirements in Section 230529 "Hangers and Supports for HVAC Piping and Equipment" for hanger, support, and anchor devices. Comply with the following requirements for maximum spacing of supports.
- B. Install the following pipe attachments:
 - 1. Adjustable steel clevis hangers for individual horizontal piping less than 20 feet long.
 - 2. Adjustable roller hangers and spring hangers for individual horizontal piping 20 feet or longer.
 - 3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet or longer, supported on a trapeze.
 - 4. Spring hangers to support vertical runs.
 - 5. Provide copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.

July 11, 2018

6. On plastic pipe, install pads or cushions on bearing surfaces to prevent hanger from scratching pipe.
- C. Install hangers for steel piping with the following maximum spacing and minimum rod sizes:
 1. NPS ¾: Maximum span, 7 feet
 2. NPS 1: Maximum span, 7 feet
 3. NPS 1-1/2: Maximum span, 9 feet
 4. NPS 2: Maximum span, 10 feet
- D. Install hangers for drawn-temper copper piping with the following maximum spacing and minimum rod sizes:
 1. NPS 3/4 (DN 20): Maximum span, 5 feet (1.5 m); minimum rod size, 1/4 inch (6.4 mm).
 2. NPS 1 (DN 25): Maximum span, 6 feet (1.8 m); minimum rod size, 1/4 inch (6.4 mm).
 3. NPS 1-1/4 (DN 32): Maximum span, 7 feet (2.1 m); minimum rod size, 3/8 inch (10 mm).
 4. NPS 1-1/2 (DN 40): Maximum span, 8 feet (2.4 m); minimum rod size, 3/8 inch (10 mm).
 5. NPS 2 (DN 50): Maximum span, 8 feet (2.4 m); minimum rod size, 3/8 inch (10 mm).
- E. Plastic Piping Hanger Spacing: Space hangers according to pipe manufacturer's written instructions for service conditions. Avoid point loading. Space and install hangers with the fewest practical rigid anchor points.
- F. Support vertical runs at roof, at each floor, and at 10-foot (3-m) intervals between floors.

3.5 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. 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.
- D. 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/A5.8M.
- E. 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.
- F. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.
- G. 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. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
 3. PVC Pressure Piping: Join ASTM D 1785 schedule number, 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.
 4. PVC Nonpressure Piping: Join according to ASTM D 2855.
- H. Grooved Joints: Assemble joints with coupling and gasket, lubricant, and bolts. Cut or roll grooves in ends of pipe based on pipe and coupling manufacturer's written instructions for pipe wall thickness. Use grooved-end fittings and rigid, grooved-end-pipe couplings.
- I. Plain-End Mechanical-Coupled Joints: Prepare, assemble, and test joints in accordance with manufacturer's written installation instructions.
- J. Mechanically Formed, Copper-Tube-Outlet Joints: Use manufacturer-recommended tool and procedure, and brazed joints.

3.6 TERMINAL EQUIPMENT CONNECTIONS

- A. Sizes for supply and return piping connections shall be the same as or larger than equipment connections.
- B. Install control valves in accessible locations close to connected equipment.
- C. Install bypass piping with globe valve around control valve. If parallel control valves are installed, only one bypass is required.
- D. Install ports for pressure gages and thermometers at coil inlet and outlet connections. Comply with requirements in Section 230519 "Meters and Gages for HVAC Piping."

3.7 FIELD QUALITY CONTROL

- A. Prepare hydronic piping according to ASME B31.9 and as follows:
1. Leave joints, including welds, uninsulated and exposed for examination during test.
 2. Provide temporary restraints for expansion joints that cannot sustain reactions due to test pressure. If temporary restraints are impractical, isolate expansion joints from testing.
 3. Flush hydronic piping systems with clean water; then remove and clean or replace strainer screens.
 4. Isolate equipment from piping. If a valve is used to isolate equipment, its closure shall be capable of sealing against test pressure without damage to valve. Install blinds in flanged joints to isolate equipment.
 5. Install safety valve, set at a pressure no more than one-third higher than test pressure, to protect against damage by expanding liquid or other source of overpressure during test.
- B. Perform the following tests on hydronic piping:
1. Use ambient temperature water as a testing medium unless there is risk of damage due to freezing. Another liquid that is safe for workers and compatible with piping may be used.

2. While filling system, use vents installed at high points of system to release air. Use drains installed at low points for complete draining of test liquid.
3. Isolate expansion tanks and determine that hydronic system is full of water.
4. Subject piping system to hydrostatic test pressure that is not less than 1.5 times the system's working pressure. Test pressure shall not exceed maximum pressure for any vessel, pump, valve, or other component in system under test. Verify that stress due to pressure at bottom of vertical runs does not exceed 90 percent of specified minimum yield strength or 1.7 times the "SE" value in Appendix A in ASME B31.9, "Building Services Piping."
5. After hydrostatic test pressure has been applied for at least 10 minutes, examine piping, joints, and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components, and repeat hydrostatic test until there are no leaks.
6. Prepare written report of testing.

C. Perform the following before operating the system:

1. Open manual valves fully.
2. Inspect pumps for proper rotation.
3. Set makeup pressure-reducing valves for required system pressure.
4. Inspect air vents at high points of system and determine if all are installed and operating freely (automatic type), or bleed air completely (manual type).
5. Set temperature controls so all coils are calling for full flow.
6. Inspect and set operating temperatures of hydronic equipment, such as boilers, chillers, cooling towers, to specified values.
7. Verify lubrication of motors and bearings.

END OF SECTION 232113

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SECTION 232116

HYDRONIC PIPING SPECIALTIES
(FILED SUB-BID REQUIRED AS PART OF SECTION 23 00 01)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Sub-Bid Requirements: As provided under Section 23 00 01 – Heating, Ventilating and Air Conditioning Filed Sub-Bid Requirements and supplemented under the Bidding Requirements, Contract Forms, and Conditions of the Contract, and applicable parts of Division 1 - General Requirements.
 - 1. Work of this Filed Sub-Bid includes all individual specification sections listed in Section 23 00 01.

1.2 SUMMARY

- A. Section Includes:
 - 1. Hydronic specialty valves.
 - 2. Air-control devices.
 - 3. Strainers.
 - 4. Connectors.
- B. Related Requirements:
 - 1. Section 230516 "Expansion Fittings and Loops for HVAC Piping" for expansion fittings and loops.
 - 2. Section 230523.12 "Ball Valves for HVAC Piping" for specification and installation requirements for ball valves common to most piping systems.
 - 3. Section 230523.14 "Check Valves for HVAC Piping" for specification and installation requirements for check valves common to most piping systems.

1.3 SUBMITTALS

- A. Product Data: For each type of product:
 - 1. Include construction details and material descriptions for hydronic piping specialties.
 - 2. Include rated capacities, operating characteristics, and furnished specialties and accessories.
 - 3. Include flow and pressure drop curves based on manufacturer's testing for calibrated-orifice balancing valves and automatic flow-control valves.
- B. Operation and maintenance data.

July 11, 2018

1.4 QUALITY ASSURANCE

- A. Pipe Welding: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code: Section IX.
- B. Safety Valves and Pressure Vessels: Shall bear the appropriate ASME label. Fabricate and stamp air separators and expansion tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

PART 2 - PRODUCTS

2.1 HYDRONIC SPECIALTY VALVES

- A. Bronze, Calibrated-Orifice, Balancing Valves:
 - 1. Body: Bronze, ball or plug type with calibrated orifice or venturi.
 - 2. Ball: Brass or stainless steel.
 - 3. Plug: Resin.
 - 4. Seat: PTFE.
 - 5. End Connections: Threaded or socket.
 - 6. Pressure Gage Connections: Integral seals for portable differential pressure meter.
 - 7. Handle Style: Lever, with memory stop to retain set position.
 - 8. CWP Rating: Minimum 125 psig (860 kPa).
 - 9. Maximum Operating Temperature: 250 deg F (121 deg C).
- B. Diaphragm-Operated, Pressure-Reducing Valves: ASME labeled.
 - 1. Body: Bronze or brass.
 - 2. Disc: Glass and carbon-filled PTFE.
 - 3. Seat: Brass.
 - 4. Stem Seals: EPDM O-rings.
 - 5. Diaphragm: EPT.
 - 6. Low inlet-pressure check valve.
 - 7. Inlet Strainer: removable without system shutdown.
 - 8. Valve Seat and Stem: Noncorrosive.
 - 9. Valve Size, Capacity, and Operating Pressure: Selected to suit system in which installed, with operating pressure and capacity factory set and field adjustable.
- C. Diaphragm-Operated Safety Valves: ASME labeled.
 - 1. Body: Bronze or brass.
 - 2. Disc: Glass and carbon-filled PTFE.
 - 3. Seat: Brass.
 - 4. Stem Seals: EPDM O-rings.
 - 5. Diaphragm: EPT.
 - 6. Wetted, Internal Work Parts: Brass and rubber.
 - 7. Inlet Strainer: removable without system shutdown.
 - 8. Valve Seat and Stem: Noncorrosive.
 - 9. Valve Size, Capacity, and Operating Pressure: Comply with ASME Boiler and Pressure Vessel Code: Section IV, and selected to suit system in which installed, with operating pressure and capacity factory set and field adjustable.
- D. Automatic Flow-Control Valves:

1. Body: Brass or ferrous metal.
2. Flow Control Assembly, provide either of the following:
 - a. Piston and Spring Assembly: Stainless steel tamper proof, self-cleaning, and removable.
 - b. Elastomeric Diaphragm and Polyphenylsulfone Orifice Plate: Operating ranges within 2- to 80-psig (14- to 550-kPa) differential pressure.
3. Combination Assemblies: Include bronze or brass-alloy ball valve.
4. Identification Tag: Marked with zone identification, valve number, and flow rate.
5. Size: Same as pipe in which installed.
6. Performance: Maintain constant flow within plus or minus 10 percent regardless of system pressure fluctuations.
7. Minimum CWP Rating: 175 psig
8. Maximum Operating Temperature: 200 deg F

2.2 AIR-CONTROL DEVICES

A. Manual Air Vents:

1. Body: Bronze.
2. Internal Parts: Nonferrous.
3. Operator: Screwdriver or thumbscrew.
4. Inlet Connection: NPS 1/2
5. Discharge Connection: NPS 1/8
6. CWP Rating: 150 psig
7. Maximum Operating Temperature: 225 deg F

B. Expansion Tanks:

1. Tank: Welded steel, rated for 125-psig (860-kPa) working pressure and 375 deg F (191 deg C) maximum operating temperature, with taps in bottom of tank for tank fitting and taps in end of tank for gage glass. Tanks shall be factory tested after taps are fabricated and shall be labeled according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
2. Air-Control Tank Fitting: Cast-iron body, copper-plated tube, brass vent tube plug, and stainless-steel ball check, 100-gal. (379-L) unit only; sized for compression-tank diameter. Provide tank fittings for 125-psig (860-kPa) working pressure and 250 deg F (121 deg C) maximum operating temperature.
3. Tank Drain Fitting: Brass body, nonferrous internal parts; 125-psig (860-kPa) working pressure and 240 deg F (116 deg C) maximum operating temperature; constructed to admit air to compression tank, drain water, and close off system.
4. Gage Glass: Full height with dual manual shutoff valves, 3/4-inch-diameter gage glass, and slotted-metal glass guard.

C. In-Line Air Separators:

1. Tank: One-piece cast iron with an integral weir constructed to decelerate system flow to maximize air separation.
2. Maximum Working Pressure: Up to 175 psig
3. Maximum Operating Temperature: Up to 300 deg F

July 11, 2018

2.3 STRAINERS

A. Y-Pattern Strainers:

1. Body: ASTM A 126, Class B, cast iron with bolted cover and bottom drain connection.
2. End Connections: Threaded ends for NPS 2 and smaller; flanged ends for NPS 2-1/2 and larger.
3. Strainer Screen: Stainless-steel, 60-mesh strainer, or perforated stainless-steel basket.
4. CWP Rating: 125 psig.

2.4 CONNECTORS

A. Stainless-Steel Bellow, Flexible Connectors:

1. Body: Stainless-steel bellows with woven, flexible, bronze, wire-reinforcing protective jacket.
2. End Connections: Threaded or flanged to match equipment connected.
3. Performance: Capable of 3/4-inch (20-mm) misalignment.
4. CWP Rating: 150 psig (1035 kPa).
5. Maximum Operating Temperature: 250 deg F (121 deg C).

PART 3 - EXECUTION

3.1 VALVE APPLICATIONS

- A. Install shutoff-duty valves at each branch connection to supply mains and at supply connection to each piece of equipment.
- B. Install calibrated-orifice, balancing valves at each branch connection to return main.
- C. Install calibrated-orifice, balancing valves in the return pipe of each heating or cooling terminal.
- D. Install check valves at each pump discharge and elsewhere as required to control flow direction.
- E. Install safety valves at hot-water generators and elsewhere as required by ASME Boiler and Pressure Vessel Code. Install drip-pan elbow on safety-valve outlet and pipe without valves to the outdoors; pipe drain to nearest floor drain or as indicated on Drawings. Comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1, for installation requirements.
- F. Install pressure-reducing valves at makeup-water connection to regulate system fill pressure.

3.2 HYDRONIC SPECIALTIES INSTALLATION

- A. Install manual air vents at high points in piping, at heat-transfer coils, and elsewhere as required for system air venting.
- B. Install piping from boiler air outlet, air separator, or air purger to expansion tank with a 2 percent upward slope toward tank.

July 11, 2018

POPE'S TAVERN
ADDITION/RENOVATION
Halifax, Massachusetts

- C. Install in-line air separators in pump suction. Install drain valve on air separators NPS 2 (DN 50) and larger.
- D. Install expansion tanks above the air separator. Install tank fitting in tank bottom and charge tank. Use manual vent for initial fill to establish proper water level in tank.
 - 1. Install tank fittings that are shipped loose.
 - 2. Support tank from floor or structure above with sufficient strength to carry weight of tank, piping connections, fittings, plus tank full of water. Do not overload building components and structural members.
- E. Install expansion tanks on the floor. Vent and purge air from hydronic system, and ensure that tank is properly charged with air to suit system Project requirements.

END OF SECTION 232116

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SECTION 232123

HYDRONIC PUMPS
(FILED SUB-BID REQUIRED AS PART OF SECTION 23 00 01)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Sub-Bid Requirements: As provided under Section 23 00 01 – Heating, Ventilating and Air Conditioning Filed Sub-Bid Requirements and supplemented under the Bidding Requirements, Contract Forms, and Conditions of the Contract, and applicable parts of Division 1 - General Requirements.
 - 1. Work of this Filed Sub-Bid includes all individual specification sections listed in Section 23 00 01.

1.2 SUMMARY

- A. Section Includes:
 - 1. Close-coupled, in-line centrifugal pumps.
 - 2. Automatic condensate pump units.

1.3 SUBMITTALS

- A. Product Data: For each type of pump.
- B. Shop Drawings: For each pump.
 - 1. Show pump layout and connections.
 - 2. Include setting drawings with templates for installing foundation and anchor bolts and other anchorages.
 - 3. Include diagrams for power, signal, and control wiring.
- C. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 CLOSE-COUPLED, IN-LINE CENTRIFUGAL PUMPS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Taco
 - 2. Bell & Gossett
 - 3. Armstrong

- B. Description: Factory-assembled and -tested, centrifugal, overhung-impeller, close-coupled, in-line pump; designed for installation with pump and motor shafts mounted horizontally or vertically.
- C. Capacities and Characteristics:
 - 1. Refer to equipment schedules on Drawing H-002 for capacities & characteristics.
- D. Pump Construction:
 - 1. Casing: Radially split, cast iron, with threaded gage tappings at inlet and outlet threaded companion-flange connections.
 - 2. Impeller: ASTM B 584, cast bronze; statically and dynamically balanced, keyed to shaft, and secured with a locking cap screw. For constant-speed pumps, trim impeller to match specified performance.
 - 3. Pump Shaft: Stainless steel.
 - 4. Seal: Mechanical seal consisting of carbon rotating ring against a ceramic seat held by a stainless-steel spring, and Buna-N bellows and gasket. Include water slinger on shaft between motor and seal.
 - 5. Seal: Packing seal consisting of stuffing box with a minimum of four rings of graphite-impregnated braided yarn with bronze lantern ring between center two graphite rings, and bronze packing gland.
 - 6. Pump Bearings: Permanently lubricated ball bearings
- E. Motor: Single speed and rigidly mounted to pump casing.
 - 1. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."
 - 2. 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.
 - a. Enclosure: Totally enclosed, fan cooled
 - b. Enclosure Materials: Cast iron.
 - c. Permanently lubricated ball bearings are available up through 5 hp. Larger motors have grease-lubricated ball bearings.
 - d. Motor Bearings: Permanently lubricated ball bearings.
 - e. Efficiency: Premium efficient.

2.2 AUTOMATIC CONDENSATE PUMP UNITS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Little Giant
 - 2. Zoeller
 - 3. Diversitech
- B. Description: Packaged units with corrosion-resistant pump, plastic tank with cover, and automatic controls. Include factory- or field-installed check valve and a 72-inch-minimum, electrical power cord with plug.
- C. Electrical Characteristics:

- a. Volts: 120
- b. Phase: Single.
- c. Hertz: 60.

PART 3 - EXECUTION

3.1 PUMP INSTALLATION

- A. Comply with HI 1.4.
- B. Install pumps to provide access for periodic maintenance including removing motors, impellers, couplings, and accessories.
- C. Independently support pumps and piping so weight of piping is not supported by pumps and weight of pumps is not supported by piping.
- D. Automatic Condensate Pump Units: Install units for collecting condensate and extend to open drain.
- E. Equipment Mounting:
 - 1. Comply with requirements for vibration isolation and seismic control devices specified in Section 230548 "Vibration and Seismic Controls for HVAC."
- F. Equipment Mounting: Install in-line pumps with continuous-thread hanger rods and elastomeric hangers of size required to support weight of in-line pumps.
 - 1. Comply with requirements for seismic-restraint devices specified in Section 230548 "Vibration and Seismic Controls for HVAC."
 - 2. Comply with requirements for hangers and supports specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."

3.2 ALIGNMENT

- A. Perform alignment service.
- B. Comply with requirements in Hydronics Institute standards for alignment of pump and motor shaft. Add shims to the motor feet and bolt motor to base frame. Do not use grout between motor feet and base frame.
- C. Comply with pump and coupling manufacturers' written instructions.
- D. After alignment is correct, tighten foundation bolts evenly but not too firmly. Completely fill baseplate with nonshrink, nonmetallic grout while metal blocks and shims or wedges are in place. After grout has cured, fully tighten foundation bolts.

3.3 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.

July 11, 2018

POPE'S TAVERN
ADDITION/RENOVATION
Halifax, Massachusetts

- B. Where installing piping adjacent to pump, allow space for service and maintenance.
- C. Connect piping to pumps. Install valves that are same size as piping connected to pumps.
- D. Install suction and discharge pipe sizes equal to or greater than diameter of pump nozzles.
- E. Install check, shutoff, and throttling valves (refer to inline pump detail on H-003 for requirements).
- F. Install Y-type strainer and shutoff valve on suction side of pumps.
- G. Install flexible connectors on suction and discharge sides of base-mounted pumps between pump casing and valves.
- H. Install pressure gages on pump suction and discharge or at integral pressure-gage tapping, or install single gage with multiple-input selector valve.
- I. Install check valve and gate or ball valve on each condensate pump unit discharge.

END OF SECTION 232123

SECTION 232300

REFRIGERANT PIPING
(FILED SUB-BID REQUIRED AS PART OF SECTION 23 00 01)

PART 1 - GENERAL

GENERAL PROVISIONS

- A. Sub-Bid Requirements: As provided under Section 23 00 01 – Heating, Ventilating and Air Conditioning Filed Sub-Bid Requirements and supplemented under the Bidding Requirements, Contract Forms, and Conditions of the Contract, and applicable parts of Division 1 - General Requirements.
 - 1. Work of this Filed Sub-Bid includes all individual specification sections listed in Section 23 00 01.

1.2 SUMMARY

- A. Section Includes:
 - 1. Refrigerant pipes and fittings.
 - 2. Refrigerant piping valves and specialties.
 - 3. Refrigerants.

1.3 SUBMITTALS

- A. Product Data: For each type of valve, refrigerant piping, and refrigerant piping specialty.
- B. Shop Drawings:
 - 1. Show piping size and 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.
 - 2. Show interface and spatial relationships between piping and equipment.
 - 3. Shop Drawing Scale: 1/4 inch equals 1 foot
- C. Field quality-control reports.
- D. Operation and Maintenance Data: For refrigerant valves and piping specialties to include in maintenance manuals.

1.4 QUALITY ASSURANCE

- A. Comply with ASHRAE 15, "Safety Code for Refrigeration Systems."
- B. Comply with ASME B31.5, "Refrigeration Piping and Heat Transfer Components."

PART 2 - PRODUCTS

2.1 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

2.2 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/A5.8M.
- F. Flexible Connectors:
 - 1. Body: Tin-bronze bellows with woven, flexible, tinned-bronze-wire-reinforced protective jacket.
 - 2. End Connections: Socket ends.
 - 3. Offset Performance: Capable of minimum 3/4-inch misalignment in minimum 7-inch-long assembly.
 - 4. Working Pressure Rating: Factory test at minimum 500 psig
 - 5. Maximum Operating Temperature: 250 deg F

2.3 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 AHRI 760 and UL 429; listed and labeled by a National Recognized Testing Laboratory (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] [115] [208]-V ac coil.
6. Working Pressure Rating: 400 psig
7. Maximum Operating Temperature: 240 deg F

F. Safety Relief Valves: Comply with 2010 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: Polytetrafluoroethylene.
4. End Connections: Threaded.
5. Working Pressure Rating: 400 psig
6. Maximum Operating Temperature: 240 deg F

G. Thermostatic Expansion Valves: Comply with AHRI 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 Reverse-flow option (for heat-pump applications).
 7. End Connections: Socket, flare, or threaded union.
 8. Working Pressure Rating: 700 psig
- H. Hot-Gas Bypass Valves: Comply with UL 429; listed and labeled by an NRTL.
1. Body, Bonnet, and Seal Cap: Ductile iron or steel.
 2. Diaphragm, Piston, Closing Spring, and Seat Insert: Stainless steel.
 3. Packing and Gaskets: Non-asbestos.
 4. Solenoid Tube, Plunger, Closing Spring, and Seat Orifice: Stainless steel.
 5. Seat: Polytetrafluoroethylene.
 6. Equalizer: Internal
 7. Electrical: Molded, watertight coil in NEMA 250 enclosure of type required by location with 1/2-inch conduit adapter and 115 V ac coil.
 8. End Connections: Socket.
 9. Throttling Range: Maximum 5 psig
 10. Working Pressure Rating: 500 psig
 11. Maximum Operating Temperature: 240 deg F
- I. Straight-Type Strainers:
1. Body: Welded steel with corrosion-resistant coating.
 2. Screen: 100-mesh stainless steel.
 3. End Connections: Socket or flare.
 4. Working Pressure Rating: 500 psig
 5. Maximum Operating Temperature: 275 deg F
- J. Angle-Type Strainers:
1. Body: Forged brass or cast bronze.
 2. Drain Plug: Brass hex plug.
 3. Screen: 100-mesh monel.
 4. End Connections: Socket or flare.
 5. Working Pressure Rating: 500 psig
 6. Maximum Operating Temperature: 275 deg F
- K. Moisture/Liquid Indicators:
1. Body: Forged brass.
 2. Window: Replaceable, clear, fused glass window with indicating element protected by filter screen.
 3. Indicator: Color coded to show moisture content in parts per million (ppm).
 4. Minimum Moisture Indicator Sensitivity: Indicate moisture above 60 ppm.
 5. End Connections: Socket or flare.
 6. Working Pressure Rating: 500 psig
 7. Maximum Operating Temperature: 240 deg F

L. Replaceable-Core Filter Dryers: Comply with AHRI 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

M. Permanent Filter Dryers: Comply with AHRI 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

2.4 REFRIGERANTS

- A. ASHRAE 34, R-410A: Pentafluoroethane/Difluoromethane.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS FOR REFRIGERANT R-410A

- A. Suction Lines: Copper, Type ACR, annealed-temper tubing and wrought-copper fittings with [brazed] [or] [soldered] joints.
- B. Hot-Gas and Liquid Lines: 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 diaphragm packless valves in suction and discharge lines of compressor.

July 11, 2018

- 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 diaphragm packless valves on inlet and outlet side of filter dryers.
- E. Install a full-size, three-valve bypass around filter dryers.
- F. Install solenoid valves upstream from each expansion valve and hot-gas bypass valve. Install solenoid valves in horizontal lines with coil at top.
- G. 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.
- H. Install safety relief valves where required by 2010 ASME Boiler and Pressure Vessel Code. Pipe safety-relief-valve discharge line to outside according to ASHRAE 15.
- I. 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.
- J. Install strainers upstream from and adjacent to the following unless they are furnished as an integral assembly for the device being protected:
 - 1. Solenoid valves.
 - 2. Thermostatic expansion valves.
 - 3. Hot-gas bypass valves.
 - 4. Compressor.
- K. Install filter dryers in liquid line between compressor and thermostatic expansion valve, and in the suction line at the compressor.
- L. Install receivers sized to accommodate pump-down charge.
- M. Install flexible connectors at compressors.

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.

July 11, 2018

- 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 adjacent to machines to allow service and maintenance.
- G. Install piping free of sags and bends.
- H. Install fittings for changes in direction and branch connections.
- I. Select system components with pressure rating equal to or greater than system operating pressure.
- J. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.
- K. 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.
- L. Install refrigerant piping in protective conduit where installed belowground.
- M. Install refrigerant piping in rigid or flexible conduit in locations where exposed to mechanical injury.
- N. 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. Install traps and double risers to entrain oil in vertical runs.
 - 4. Liquid lines may be installed level.
- O. 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.
- P. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation.
- Q. Identify refrigerant piping and valves according to Section 230553 "Identification for HVAC Piping and Equipment."
- R. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 230517 "Sleeves and Sleeve Seals for HVAC Piping."
- S. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 230517 "Sleeves and Sleeve Seals for HVAC Piping."

- T. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 230518 "Escutcheons for HVAC Piping."

3.4 PIPE JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- C. Soldered Joints: Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook."
- D. 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.

3.5 HANGERS AND SUPPORTS

- A. Comply with requirements for pipe hangers and supports specified in Section 230529 "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. Roller hangers and spring hangers for individual horizontal runs 20 feet or longer.
 - 3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet or longer, supported on a trapeze.
 - 4. Spring hangers to support vertical runs.
 - 5. 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 diameters:
 - 1. NPS ½: Maximum span, 60 inches, minimum rod, 1/4 inch
 - 2. NPS 5/8: Maximum span, 60 inches, minimum rod, 1/4 inch
 - 3. NPS 1: Maximum span, 72 inches minimum rod, 1/4 inch,
- D. Support multifloor vertical runs at least at each floor.

3.6 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. Comply with ASME B31.5, Chapter VI.

July 11, 2018

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.
3. Test high- and low-pressure side piping of each system separately at not less than the pressures indicated in "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.

B. Prepare test and inspection reports.

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. 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

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SECTION 233300

AIR DUCT ACCESSORIES
(FILED SUB-BID REQUIRED AS PART OF SECTION 23 00 01)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Sub-Bid Requirements: As provided under Section 23 00 01 – Heating, Ventilating and Air Conditioning Filed Sub-Bid Requirements and supplemented under the Bidding Requirements, Contract Forms, and Conditions of the Contract, and applicable parts of Division 1 - General Requirements.
 - 1. Work of this Filed Sub-Bid includes all individual specification sections listed in Section 23 00 01.

1.2 SUMMARY

- A. Section Includes:
 - 1. Backdraft and pressure relief dampers.
 - 2. Manual volume dampers.
 - 3. Control dampers.
 - 4. Fire dampers.
 - 5. Smoke dampers.
 - 6. Flange connectors.
 - 7. Duct-mounted access doors.
 - 8. Flexible connectors.
 - 9. Duct accessory hardware.

1.3 SUBMITTALS

- A. Product Data: For each type of product.
- B. Operation and maintenance data.

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
 - 2. Exposed-Surface Finish: Mill phosphatized.
- B. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304, and having a No. 2 finish for concealed ducts and finish for exposed ducts.
- C. Aluminum Sheets: Comply with ASTM B 209 Alloy 3003, Temper H14; with mill finish for concealed ducts and standard, 1-side bright finish for exposed ducts.
- D. Extruded Aluminum: Comply with ASTM B 221 ,Alloy 6063, Temper T6.
- E. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.
- F. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches .

2.3 BACKDRAFT AND PRESSURE RELIEF DAMPERS

- A. Description: Gravity balanced.
- B. Maximum Air Velocity: 1000 fpm
- C. Maximum System Pressure: 2-inch wg
- D. Frame: Hat-shaped, 0.05-inch-thick, galvanized sheet steel, with welded corners or mechanically attached and mounting flange.
- E. Blades: Multiple single-piece blades, end pivoted,]maximum 6-inch width, 0.025-inch-thick, roll-formed aluminum with sealed edges.
- F. Blade Action: Parallel.
- G. Blade Seals: Neoprene, mechanically locked.
- H. Blade Axles:
 - 1. Material: Galvanized steel.
 - 2. Diameter: 0.20 inch
- I. Tie Bars and Brackets: Galvanized steel.
- J. Return Spring: Adjustable tension.

K. Bearings: Steel ball or synthetic pivot bushings.

L. Accessories:

1. Adjustment device to permit setting for varying differential static pressure.
2. Counterweights and spring-assist kits for vertical airflow installations.
3. Electric actuators.
4. Chain pulls.
5. Screen Mounting: Front mounted in sleeve.
 - a. Sleeve Thickness: 20 gage minimum.
 - b. Sleeve Length: 6 inches minimum.
6. Screen Mounting: Rear mounted.
7. Screen Material: Galvanized steel.
8. Screen Type: Insect.
9. 90-degree stops.

2.4 MANUAL VOLUME DAMPERS

A. Standard, Steel, Manual Volume Dampers:

1. Standard leakage rating.
2. Suitable for horizontal or vertical applications.
3. Frames:
 - a. Frame: Hat-shaped, 0.094-inch-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 thick.
5. Blade Axles: Galvanized steel
6. Bearings:
 - a. Oil-impregnated bronze.
 - b. Dampers in ducts with pressure classes of 3-inch wg 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. Standard, Aluminum, Manual Volume Dampers:

1. Standard leakage rating.
2. Suitable for horizontal or vertical applications.

3. Frames: Hat-shaped, 0.10-inch-thick, aluminum sheet channels; frames with 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. Roll-Formed Aluminum Blades: 0.10-inch-thick aluminum sheet.
 - e. Extruded-Aluminum Blades: 0.050-inch-thick extruded aluminum.
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: Aluminum.

C. Jackshaft:

1. Size: 0.5-inch diameter.
2. Material: Galvanized-steel pipe rotating within pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.
3. Length and Number of Mountings: As required to connect linkage of each damper in multiple-damper assembly.

D. Damper Hardware:

1. Zinc-plated, die-cast core with dial and handle made of 3/32-inch-thick zinc-plated steel, and a 3/4-inch hexagon locking nut.
2. Include center hole to suit damper operating-rod size.
3. Include elevated platform for insulated duct mounting.

2.5 CONTROL DAMPERS

A. Frames:

1. Hat shaped.
2. 0.094-inch-thick, galvanized sheet steel.
3. Mitered and welded corners.

B. Blades:

1. Multiple blade with maximum blade width of 6 inches.
2. Opposed-blade design.
3. Galvanized-steel
4. Blade Edging: Closed-cell neoprene.
5. Blade Edging: Inflatable seal blade edging, or replaceable rubber seals.

- C. Blade Axles: 1/2-inch-diameter; galvanized steel; blade-linkage hardware of zinc-plated steel and brass; ends sealed against blade bearings.
 - 1. Operating Temperature Range: From minus 40 to plus 200 deg F
- D. Bearings:
 - 1. Oil-impregnated bronze
 - 2. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
 - 3. Thrust bearings at each end of every blade.

2.6 FIRE DAMPERS

- A. Type: Static and dynamic; rated and labeled according to UL 555 by an NRTL.
- B. Closing rating in ducts up to 4-inch wg static pressure class and minimum 2000-fpm velocity.
- C. Fire Rating: 1-1/2 and 3 hours.
- D. Frame: Curtain type with blades outside airstream except when located behind grille where blades may be inside airstream; fabricated with roll-formed, 0.034-inch-thick galvanized steel; with mitered and interlocking corners.
- E. Mounting Sleeve: Factory- or field-installed, galvanized sheet steel.
 - 1. Minimum Thickness: 0.05 inch thick, as indicated, and of length to suit application.
 - 2. Exception: Omit sleeve where damper-frame width permits direct attachment of perimeter mounting angles on each side of wall or floor; thickness of damper frame must comply with sleeve requirements.
- F. Mounting Orientation: Vertical or horizontal as indicated.
- G. Blades: Roll-formed, interlocking, 0.034-inch-thick, galvanized sheet steel. In place of interlocking blades, use full-length, 0.034-inch-thick, galvanized-steel blade connectors.
- H. Horizontal Dampers: Include blade lock and stainless-steel closure spring.
- I. Heat-Responsive Device: Replaceable, 165 deg F rated, fusible links.

2.7 SMOKE DAMPERS

- A. General Requirements: Label according to UL 555S by an NRTL.
- B. Smoke Detector: Integral, factory wired for single-point connection.
- C. Frame: Hat-shaped, 0.094-inch-thick, galvanized sheet steel, with welded corners.
- D. Blades: Roll-formed, horizontal, interlocking, 0.034-inch-thick, galvanized sheet steel.

July 11, 2018

- E. Leakage: Class II
- F. Rated pressure and velocity to exceed design airflow conditions.
- G. Mounting Sleeve: Factory-installed, 0.05-inch-thick, galvanized sheet steel; length to suit wall or floor application with factory-furnished silicone caulking.
- H. Damper Motors: Two-position action.
- I. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."
 - 1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
 - 2. Permanent-Split-Capacitor or Shaded-Pole Motors: With oil-immersed and sealed gear trains.
 - 3. Spring-Return Motors: Equip with an integral spiral-spring mechanism where indicated. Enclose entire spring mechanism in a removable housing designed for service or adjustments. Size for running torque rating of 150 in. x lbf and breakaway torque rating of 150 in. x lbf.
 - 4. Outdoor Motors and Motors in Outdoor-Air Intakes: Equip with O-ring gaskets designed to make motors weatherproof. Equip motors with internal heaters to permit normal operation at minus 40 deg F.
 - 5. Nonspring-Return Motors: For dampers larger than 25 sq. ft. size motor for running torque rating of 150 in. x lbf (17 N x m) and breakaway torque rating of 300 in. x lbf.
 - 6. Electrical Connection: 115 V, single phase, 60 Hz

2.8 FLANGE CONNECTORS

- A. Description: Add-on or roll-formed, factory-fabricated, slide-on transverse flange connectors, gaskets, and components.
- B. Material: Galvanized steel.
- C. Gage and Shape: Match connecting ductwork.

2.9 DUCT-MOUNTED ACCESS DOORS

- A. Duct-Mounted Access Doors: Fabricate access panels according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 7-2, "Duct Access Doors and Panels," and 7-3, "Access Doors - Round Duct."
 - 1. Door:
 - a. Double wall, rectangular.
 - b. Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class.
 - c. Vision panel.
 - d. Hinges and Latches: 1-by-1-inch butt or piano hinge and cam latches.

- e. Fabricate doors airtight and suitable for duct pressure class.
- 2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
- 3. Number of Hinges and Locks:
 - a. Access Doors Less Than 12 Inches Square: No hinges and two sash locks.
 - b. Access Doors up to 18 Inches Square: Two hinges and two sash locks.
 - c. Access Doors up to 24 by 48 Inches Three hinges and two compression latches.
 - d. Access Doors Larger Than 24 by 48 Inches : Four hinges and two compression latches with outside and inside handles.

2.10 DUCT ACCESS PANEL ASSEMBLIES

- A. Labeled according to UL 1978 by an NRTL.
- B. Panel and Frame: Minimum thickness 0.0528-inch carbon
- C. Fasteners: Carbon steel. Panel fasteners shall not penetrate duct wall.
- D. Gasket: Comply with NFPA 96; grease-tight, high-temperature ceramic fiber, rated for minimum 2000 deg F.
- E. Minimum Pressure Rating: 10-inch wg, positive or negative.

2.11 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 3-1/2 inches wide attached to two strips of 2-3/4-inch-wide, 0.028-inch- thick, galvanized sheet steel or 0.032-inch-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. .
 - 2. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
 - 3. Service Temperature: Minus 40 to plus 200 deg F.

2.12 DUCT ACCESSORY HARDWARE

- A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.
- B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

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 backdraft dampers at inlet of exhaust fans or exhaust ducts as close as possible to exhaust fan unless otherwise indicated.
- D. Install volume dampers at points on supply, return, and exhaust 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.
- E. Set dampers to fully open position before testing, adjusting, and balancing.
- F. Install test holes at fan inlets and outlets and elsewhere as indicated.
- G. Install fire and smoke dampers according to UL listing.
- H. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:
 - 1. On both sides of duct coils.
 - 2. Upstream from duct filters.
 - 3. At outdoor-air intakes and mixed-air plenums.
 - 4. At drain pans and seals.
 - 5. Downstream from manual volume dampers, control dampers, backdraft dampers, and equipment.
 - 6. Adjacent to and close enough to fire or smoke dampers, to reset or reinstall fusible links. Access doors for access to fire or smoke dampers having fusible links shall be pressure relief access doors and shall be outward operation for access doors installed upstream from dampers and inward operation for access doors installed downstream from dampers.
 - 7. At each change in direction and at maximum 50-foot spacing.
 - 8. Upstream from turning vanes.
 - 9. Upstream or downstream from duct silencers.
 - 10. Control devices requiring inspection.
 - 11. Elsewhere as indicated.
- I. Install access doors with swing against duct static pressure.
- J. Access Door Sizes:

1. One-Hand or Inspection Access: 8 by 5 inches
 2. Two-Hand Access: 12 by 6 inches
 3. Head and Hand Access: 18 by 10 inches
 4. Head and Shoulders Access: 21 by 14 inches
 5. Body Access: 25 by 14 inches
 6. Body plus Ladder Access: 25 by 17 inches
- K. Label access doors according to Section 230553 "Identification for HVAC Piping and Equipment" to indicate the purpose of access door.
- L. Install flexible connectors to connect ducts to equipment.
- M. Connect terminal units to supply ducts with maximum 12-inch lengths of flexible duct. Do not use flexible ducts to change directions.
- N. Connect diffusers or light troffer boots to ducts with maximum 60-inch lengths of flexible duct clamped or strapped in place.
- O. Connect flexible ducts to metal ducts with draw bands.
- P. Install duct test holes where required for testing and balancing purposes.
- 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 and smoke 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.

END OF SECTION 233300

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SECTION 233533

LISTED KITCHEN VENTILATION SYSTEM EXHAUST DUCTS
(FILED SUB-BID REQUIRED AS PART OF SECTION 23 00 01)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Sub-Bid Requirements: As provided under Section 23 00 01 – Heating, Ventilating and Air Conditioning Filed Sub-Bid Requirements and supplemented under the Bidding Requirements, Contract Forms, and Conditions of the Contract, and applicable parts of Division 1 - General Requirements.
 - 1. Work of this Filed Sub-Bid includes all individual specification sections listed in Section 23 00 01.

1.2 SUMMARY

- A. Section Includes:
 - 1. Listed grease ducts.
 - 2. Access doors.

1.3 SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For listed grease ducts.
 - 1. Include plans, elevations, sections, and attachment 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. Detail fabrication and assembly of hangers and seismic restraints.
- C. Welding certificates.

1.4 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports.
 - 2. AWS D9.1/D9.1M, "Sheet Metal Welding Code," for shop and field welding of joints and seams in listed grease ducts and field-fabricated grease ducts.

PART 2 - PRODUCTS

2.1 LISTED GREASE DUCTS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. McGill AirFlow LLC.
 2. Metal-Fab, Inc.
 3. Schebler Co. (The).
 4. Selkirk Corporation.
 5. Sisneros Bros Mfg., LLC.
- B. Description: Factory-fabricated, -listed, and -labeled, double-wall ducts tested according to UL 1978 and rated for 500 deg F continuously, or 2000 deg F for 30 minutes; with positive or negative duct pressure and complying with NFPA 211.
- C. Construction: Inner shell and outer jacket separated by at least a 2-inch annular space filled with high-temperature, ceramic-fiber insulation.
1. Inner Shell: ASTM A666, Type 304 stainless steel.
 2. Outer Jacket: Stainless steel where concealed. Stainless steel where exposed.
- D. Gaskets and Flanges: Ensure that gaskets and sealing materials are rated at 1500 deg F minimum.
- E. Hood Connectors: Constructed from same material as grease duct with internal or external continuously welded or brazed joints.
- F. Accessories: Tees, elbows, increasers, terminations, adjustable roof flashings, storm collars, support assemblies, thimbles, firestop spacers, and fasteners; fabricated from similar materials and designs as vent-pipe straight sections; all listed for same assembly. Include unique components required to comply with NFPA 96 including cleanouts, transitions, adapters, and drain fittings.
- G. Grease Duct Supports: Construct duct bracing and supports from non-combustible material.
1. Design bracing and supports to carry static and seismic loads within stress limitations of the International Building Code.
 2. Ensure that bolts, screws, rivets and other mechanical fasteners do not penetrate duct walls.
- H. Comply with ASTM E2336.
- I. Factory Tests: Test and inspect fire resistance of grease duct system according to ASTM E2336 in presence of local authority having jurisdiction.
1. Allow consultant two days' minimum notification before test is performed.

2.2 ACCESS DOORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. 3M.
 2. Acudor Products, Inc.
 3. Ductmate Industries, Inc.
 4. Sachwin Products, Inc.
- B. Description: Factory-fabricated, -listed, and -labeled, double-wall personnel and maintenance access doors tested according to UL 1978 and rated for 500 deg F continuously, or 2000 deg F for 30 minutes; with positive or negative duct pressure and complying with NFPA 211.
1. Construction: 0.0625 inch ASTM A666, Type 304 stainless-steel inner shell and stainless-steel outer cover with two handles.
 2. Fasteners: Stainless-steel bolts and wing nuts.
 - a. Ensure that bolts do not penetrate interior of duct space.
 3. Maintenance Access Door Dimensions: 7 x 7 inches.
 4. Personnel Access Door Dimensions: 22 x 20 inches.
 5. Door Label: Mark door with uppercase lettering as follows: "ACCESS PANEL. DO NOT OBSTRUCT."

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Coordinate installation of roof curbs, equipment supports, and roof penetrations. Comply with requirements in Section 077200 "Roof Accessories."
- B. Coordinate connections to kitchen exhaust hoods with requirements in Section 233813 "Commercial-Kitchen Hoods."
- C. Coordinate firestopping where grease ducts penetrate fire separations with requirements in Section 078413 "Penetration Firestopping."
- D. Comply with minimum clearances from combustibles and minimum termination heights according to product listing or NFPA 211 and UL 2221, whichever is most stringent.
- E. Install airtight personnel and maintenance access doors where indicated.
- F. Seal between sections of grease exhaust ducts according to manufacturer's written installation instructions, using sealants recommended by manufacturer.
- G. Connections: Make grease duct connections according to the International Mechanical Code.

1. Grease duct to exhaust fan connections: Connect grease ducts to inlet side of fan using flanges, gaskets, and bolts.
 2. Grease duct to hood connections:
 - a. Make grease duct to hood joints connections using internal or external continuously welded or brazed joints.
 - b. Make watertight grease duct to hood joints connections using flanges, gaskets, and bolts.
- H. Support ducts at intervals recommended by manufacturer to support weight of ducts and accessories, without applying loading on kitchen hoods.
1. Securely attach supports and bracing to structure.
- I. Grease Duct Enclosures: Comply with requirements of the International Building Code and ASTM E2336.
- J. Coordinate fire-rated enclosure construction with Section 092116.23 "Gypsum Board Shaft Wall Assemblies."
- K. Repair damage to adjacent materials caused by listed kitchen ventilation system exhaust ducts installation.
- 3.2 FIELD QUALITY CONTROL
- A. Perform air leakage test in presence of local authority having jurisdiction before concealment of any portion of the grease duct system.
1. Notify Owner a minimum of two days before test is performed.

END OF SECTION 233533

SECTION 233813

COMMERCIAL-KITCHEN HOODS
(FILED SUB-BID REQUIRED AS PART OF SECTION 23 00 01)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Sub-Bid Requirements: As provided under Section 23 00 01 – Heating, Ventilating and Air Conditioning Filed Sub-Bid Requirements and supplemented under the Bidding Requirements, Contract Forms, and Conditions of the Contract, and applicable parts of Division 1 - General Requirements.
 - 1. Work of this Filed Sub-Bid includes all individual specification sections listed in Section 23 00 01.

1.2 SUMMARY

- A. Section includes Type I commercial-kitchen hoods.
- B. Related Requirements:
 - 1. Section 233533 "Listed Kitchen Ventilation System Exhaust Ducts" for fire-rated ducts connecting to kitchen hoods.

1.3 SUBMITTALS

- A. Product Data: For the following:
 - 1. Filters/baffles.
 - 2. Fire-suppression systems.
 - 3. Lighting fixtures.
- B. Shop Drawings:
 - 1. Show plan view, elevation view, sections, roughing-in dimensions, service requirements, duct connection sizes, and attachments to other work.
 - 2. Show cooking equipment plan and elevation to confirm minimum code-required overhang.
 - 3. Indicate performance, exhaust and makeup air airflow, and pressure loss at actual Project-site elevation.
 - 4. Show control cabinets.
 - 5. Show fire-protection cylinders, piping, actuation devices, and manual control devices.
 - 6. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 7. Design Calculations: Calculate requirements for selecting seismic restraints.
 - 8. Include diagrams for power, signal, and control wiring.

9. Duct Connections: Detail connections between ducts and hoods, including access doors and panels.
 10. Piping Diagrams: Detail fire-suppression piping and components and differentiate between manufacturer-installed and field-installed piping. Show cooking equipment plan and elevation to illustrate fire-suppression nozzle locations.
- C. Welding certificates.
- D. Manufacturer Seismic Qualification Certification: Submit certification that commercial-kitchen hoods, accessories, and components will withstand seismic forces defined in Section 230548 "Vibration and Seismic Controls for HVAC."
- E. Field quality-control reports.

1.4 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D 1.1M, "Structural Welding Code - Steel," for hangers and supports; and AWS D9.1/D9.1M, "Sheet Metal Welding Code," for joint and seam welding.

PART 2 - PRODUCTS

2.1 PERFORMANCE 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.

2.2 HOOD MATERIALS

- A. Stainless-Steel Sheet: ASTM A 666, Type 304.
1. Minimum Thickness: 0.050 inch.
 2. Finish: Comply with SSINA's "Finishes for Stainless Steel" for recommendations for applying and designating finishes.
 - a. Finish shall be free from tool and die marks and stretch lines and shall have uniform, directionally textured, polished finish indicated, free of cross scratches. Grain shall run with long dimension of each piece.
 3. Concealed Stainless-Steel Surfaces: ASTM A 480/A 480M, No. 2B finish (bright, cold-rolled, unpolished finish).
 4. Exposed Surfaces: ASTM A 480/A 480M, No. 2B finish (bright, cold-rolled, unpolished).
 5. Exposed Surfaces: ASTM A 480/A 480M, No. 3 finish (intermediate polished surface).
 6. Exposed Surfaces: ASTM A 480/A 480M, No. 4 finish (directional satin).
 7. Exposed Surfaces: ASTM A 480/A 480M, No. 6 finish (dull satin).
 8. Exposed Surfaces: ASTM A 480/A 480M, No. 7 finish (reflective, directional polish).
 9. Exposed Surfaces: ASTM A 480/A 480M, No. 8 finish (mirrorlike reflective, nondirectional polish).

July 11, 2018

10. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
- B. Zinc-Coated Steel Shapes: ASTM A 36/A 36M, zinc coated according to ASTM A 123/A 123M requirements.
- C. Sealant: ASTM C 920; Type S, Grade NS, Class 25, Use NT. Elastomeric sealant shall be NSF certified for commercial-kitchen hood application. Sealants, when cured and washed, shall comply with requirements in 21 CFR 177.2600, for use in areas that come in contact with food.
 1. Color: As selected by Architect from manufacturer's full range.
 2. Backer Rod: Closed-cell polyethylene, in diameter larger than joint width.
- D. Sound Dampening: NSF-certified, non-absorbent, hard-drying, sound-deadening compound for permanent adhesion to metal in minimum 1/8-inch thickness that does not chip, flake, or blister.
- E. Gaskets: NSF certified for end-use application indicated; of resilient rubber, neoprene, or PVC that is nontoxic, stable, odorless, nonabsorbent, and unaffected by exposure to foods and cleaning compounds, and that passes testing according to UL 710.

2.3 GENERAL HOOD FABRICATION REQUIREMENTS

- A. Welding: Use welding rod of same composition as metal being welded. Use methods that minimize distortion and develop strength and corrosion resistance of base metal. Make ductile welds free of mechanical imperfections such as gas holes, pits, or cracks.
 1. Welded Butt Joints: Full-penetration welds for full-joint length. Make joints flat, continuous, and homogenous with sheet metal without relying on straps under seams, filling in with solder, or spot welding.
 2. Grind exposed welded joints flush with adjoining material and polish to match adjoining surfaces.
 3. Where fasteners are welded to underside of equipment, finish reverse side of weld smooth and flush.
 4. Coat concealed stainless-steel welded joints with metallic-based paint to prevent corrosion.
 5. After zinc-coated steel is welded, clean welds and abraded areas and apply SSPC-Paint 20, high-zinc-dust-content, galvanizing repair paint to comply with ASTM A 780/A 780M.
- B. For metal butt joints, comply with SMACNA's "Kitchen Ventilation Systems & Food Service Equipment Guidelines."
- C. Where stainless steel is joined to a dissimilar metal, use stainless-steel welding material or fastening devices.
- D. Form metal with break bends that are not flaky, scaly, or cracked in appearance; where breaks mar uniform surface appearance of material, remove marks by grinding, polishing, and finishing.
- E. Sheared Metal Edges: Finish free of burrs, fins, and irregular projections.
- F. In food zones, as defined in NSF, fabricate surfaces free from exposed fasteners.

July 11, 2018

- G. Cap exposed fastener threads, including those inside cabinets, with stainless-steel lock washers and stainless-steel cap (acorn) nuts.
- H. Fabricate pipe slots on equipment with turned-up edges sized to accommodate service and utility lines and mechanical connections.
- I. Fabricate enclosures, including panels, housings, and skirts, to conceal service lines, operating components, and mechanical and electrical devices including those inside cabinets unless otherwise indicated.
- J. Fabricate seismic restraints according to SMACNA's "Kitchen Ventilation Systems & Food Service Equipment Guidelines," Appendix A, "Seismic Restraint Details."
- K. Fabricate equipment edges and backsplashes according to SMACNA's "Kitchen Ventilation Systems & Food Service Equipment Guidelines."
- L. Fabricate enclosure panels to ceiling and wall as follows:
 - 1. Fabricate panels on all exposed side(s) with same material as hood, and extend from ceiling to top of hood canopy and from canopy to wall.
 - 2. Wall Offset Spacer: Minimum of 3 inches.
 - 3. Wall Shelves and Overshelves: Fabricate according to SMACNA's "Kitchen Ventilation Systems & Food Service Equipment Guidelines," with minimum 0.0625-inch-thick, stainless-steel shelf tops.

2.4 TYPE I EXHAUST HOOD FABRICATION

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Greenheck Fan Corporation.
 - 2. Captive-Aire Systems.
 - 3. Accurex
- B. Weld all joints exposed to grease with continuous welds, and make filters/baffles or grease extractors and makeup air diffusers easily accessible for cleaning.
 - 1. Fabricate hoods according to NSF 2, "Food Equipment."
 - 2. Hoods shall be listed and labeled, according to UL 710, by a testing agency acceptable to authorities having jurisdiction.
 - 3. Include access panels as required for access to fire dampers and fusible links.
 - 4. Duct Collars: Minimum 0.0598-inch-thick steel at least 3 inches long, continuously welded to top of hood and at corners. Fabricate a collar with a 0.5-inch-wide duct flange.
 - 5. Duct-Collar Fire Dampers: Collar and damper shall comply with UL 710 testing and listing required for the entire hood.
 - a. Collar: Minimum 0.0598-inch-thick stainless steel, at least 3 inches long, continuously welded to top of hood and at corners. Fabricate a collar with a minimum 0.5-inch-wide duct flange.
 - b. Blades: Minimum 0.1046-inch-thick stainless steel, counterbalanced to remain closed after actuation.

- c. Blade Pivot and Spring: Stainless steel.
 - d. Fusible Link: Replaceable, 212 deg F rated.
 - 6. Makeup Air Fire Dampers: Labeled, according to UL 555, by a testing agency acceptable to authorities having jurisdiction.
 - a. Fire Rating: 1-1/2 hours.
 - b. Frame: SMACNA [**Type B**], with blades in airstream; fabricated with roll-formed, stainless steel; with mitered and interlocking corners.
 - c. Blades: Roll-formed, interlocking or folded, minimum 0.034-inch-thick, galvanized-steel sheet.
 - d. Horizontal Dampers: Include a blade lock and stainless-steel closure spring.
 - e. Fusible Link: Replaceable, 212 deg F rated.
 - C. Hood Configuration: Exhaust only.
 - D. Hood Style: Back shelf.
 - E. Filters/Baffles: Removable, stainless-steel, with spring-loaded fastening. Fabricate stainless steel for filter frame and removable collection cup and pitched trough. Exposed surfaces shall be pitched to drain to collection cup. Filters/baffles shall be tested according to UL 1046, "Safety for Grease Filters for Exhaust Ducts," by an NRTL acceptable to authorities having jurisdiction.
 - F. Hood Controls: Wall-mounting control cabinet, fabricated of stainless steel.
 - 1. Exhaust Fan: On-off switches shall start and stop the exhaust fan. Interlock exhaust fan with makeup air supply fan to operate simultaneously. Interlock exhaust fan with fire-suppression system to operate fan(s) during fire-suppression-agent release and to remain in operation until manually stopped. Include red pilot light to indicate fan operation. Motor starters shall comply with Section 262913 "Enclosed Controllers."
 - 2. Exhaust Fan Interlock: Factory wire the exhaust fan starters in a single control cabinet for adjacent hoods to operate together.
 - 3. High-Temperature Control: Alarm shall sound and cooking equipment shall shut down before hood discharge temperature rises to actuation temperature of fire-suppression system.
 - G. Capacities and Characteristics:
 - 1. Nominal Hood Length: 42 inches
 - 2. Nominal Hood Width 36 inches
 - 3. Canopy Height: 24 inches
 - 4. Exhaust Airflow: 788 CFM
 - 5. Exhaust-Air Pressure Loss: 0.445 in. wg
- 2.5 WET-CHEMICAL FIRE-SUPPRESSION SYSTEM
- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Ansul Incorporated; Tyco International.
 - 2. Badger Fire Protection.

3. Kidde Fire Systems.
 - B. Description: Engineered distribution piping designed for automatic detection and release or manual release of fire-suppression agent by hood operator. Fire-suppression system shall be listed and labeled for complying with NFPA 17A, "Wet Chemical Extinguishing Systems," by a qualified testing agency acceptable to authorities having jurisdiction.
 1. Steel Pipe, NPS 2 and Smaller: ASTM A 53/A 53M, Type S, Grade A, Schedule 40, plain ends.
 2. Malleable-Iron Threaded Fittings: ASME B16.3, Classes 150 and 300.
 3. Piping, fusible links and release mechanism, tank containing the suppression agent, and controls shall be factory installed. Controls shall be in stainless-steel control cabinet mounted on hood or wall. Furnish manual pull station for wall mounting. Exposed piping shall be covered with chrome-plated aluminum tubing. Exposed fittings shall be chrome plated.
 4. Liquid Extinguishing Agent: Noncorrosive, low-pH liquid.
 5. Furnish electric-operated gas shutoff valve
 6. Furnish electric-operated gas shutoff valve with clearly marked open and closed indicator for field installation.
 7. Fire-suppression system controls shall be integrated with controls for fans, lights, and fuel supply and located in a single cabinet for each group of hoods immediately adjacent.
 8. Wiring shall have color-coded, numbered terminal blocks and grounding bar. Spare terminals for fire alarm, optional wiring to start fan with fire alarm, red pilot light to indicate fan operation, and control switches shall all be factory wired in control cabinet with relays or starters. Include spare terminals for fire alarm, and wiring to start fan with fire alarm.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Coordinate equipment layout and installation with adjacent Work, including lighting fixtures, HVAC equipment, plumbing, and fire-suppression system components.
- B. Complete field assembly of hoods where required.
 1. Make closed butt and contact joints that do not require filler.
 2. Grind field welds on stainless-steel equipment smooth, and polish to match adjacent finish. Comply with welding requirements in "General Hood Fabrication Requirements" Article.
- C. Install hoods and associated services with clearances and access for maintaining, cleaning, and servicing hoods, filters/baffles, grease extractor, and fire-suppression systems according to manufacturer's written instructions and requirements of authorities having jurisdiction.
- D. Make cutouts in hoods where required to run service lines and to make final connections, and seal openings according to UL 1978.
- E. Securely anchor and attach items and accessories to walls, floors, or bases with stainless-steel fasteners unless otherwise indicated.
- F. Install hoods to operate free from vibration.

July 11, 2018

- G. Install seismic restraints according to SMACNA's "Kitchen Ventilation Systems & Food Service Equipment Guidelines," Appendix A, "Seismic Restraint Details."
- H. Install trim strips and similar items requiring fasteners in a bed of sealant. Fasten with stainless-steel fasteners at 48 inches o.c. maximum.
- I. Install sealant in joints between equipment and abutting surfaces with continuous joint backing unless otherwise indicated. Provide airtight, watertight, vermin-proof, sanitary joints.
- J. Install lamps, with maximum recommended wattage, in equipment with integral lighting.
- K. Set initial temperatures, and calibrate sensors.
- L. Set field-adjustable switches.
- M. Weld exhaust-duct connections with continuous liquidtight joint.
- N. Install fire-suppression piping for remote-mounted suppression systems according to NFPA 17A, "Wet Chemical Extinguishing Systems."

3.2 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. Test each equipment item for proper operation. Repair or replace equipment that is defective, including units that operate below required capacity or that operate with excessive noise or vibration.
 - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 - 3. Perform hood performance tests required by authorities having jurisdiction.
 - 4. Perform fire-suppression system performance tests required by authorities having jurisdiction.
- B. Commercial-kitchen hoods will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

END OF SECTION 233813

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SECTION 235216

CONDENSING BOILERS
(FILED SUB-BID REQUIRED AS PART OF SECTION 23 00 01)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Sub-Bid Requirements: As provided under Section 23 00 01 – Heating, Ventilating and Air Conditioning Filed Sub-Bid Requirements and supplemented under the Bidding Requirements, Contract Forms, and Conditions of the Contract, and applicable parts of Division 1 - General Requirements.
 - 1. Work of this Filed Sub-Bid includes all individual specification sections listed in Section 23 00 01.

1.2 SUMMARY

- A. Section includes gas-fired, fire-tube condensing boilers, trim, and accessories for generating hot water.

1.3 SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For boilers, boiler trim, and accessories. Include plans, elevations, sections, and mounting details.
 - 1. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 2. Include diagrams for power, signal, and control wiring.
- C. Seismic Qualification Data: Certificates, for boiler, accessories, and components, from manufacturer.
- D. Source quality-control reports.
- E. Field quality-control reports.
- F. Sample Warranty: For special warranty.
- G. Operation and maintenance data.

1.4 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to repair or replace components of boilers that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period for Fire-Tube Condensing Boilers:
 - a. Leakage and Materials: 10 years from date of Substantial Completion.
 - b. Heat Exchanger Damaged by Thermal Stress and Corrosion: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE 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. ASME Compliance: Fabricate and label boilers to comply with 2010 ASME Boiler and Pressure Vessel Code.
- C. ASHRAE/IES 90.1 Compliance: Boilers shall have minimum efficiency according to "Gas and Oil Fired Boilers - Minimum Efficiency Requirements."
- D. DOE Compliance: Minimum efficiency shall comply with 10 CFR 430, Subpart B, Appendix N.
- E. UL Compliance: Test boilers for compliance with UL 795. Boilers shall be listed and labeled by a testing agency acceptable to authorities having jurisdiction.
- F. CSA Compliance: Test boilers for compliance with CSA B51.
- G. Mounting Base: For securing boiler to concrete base.
 - 1. Seismic Fabrication Requirements: Fabricate mounting base and attachment to boiler pressure vessel, accessories, and components with reinforcement strong enough to withstand seismic forces defined in Section 230548 "Vibration and Seismic Controls for HVAC" when mounting base is anchored to building structure.

2.2 FORCED-DRAFT, FIRE-TUBE CONDENSING BOILERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Lochinvar.
 - 2. HTP.
 - 3. Weil McLain.

July 11, 2018

- B. Description: Factory-fabricated, -assembled, and -tested, fire-tube condensing boiler with heat exchanger sealed pressure tight, built on a steel base, including insulated jacket; flue-gas vent; combustion-air intake connections; water supply, return, and condensate drain connections; and controls. Water-heating service only.
- C. Heat Exchanger: Nonferrous, corrosion-resistant combustion chamber.
- D. Pressure Vessel: Carbon steel with welded heads and tube connections.
- E. Burner: Natural gas, forced draft.
- F. Blower: Centrifugal fan to operate during each burner firing sequence and to prepurge and postpurge the combustion chamber.
 - 1. Motors: Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."
 - a. Motor Sizes: Minimum size as indicated; if not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
- G. Gas Train: Combination gas valve with manual shutoff and pressure regulator.
- H. Ignition: Spark ignition with 100 percent main-valve shutoff with electronic flame supervision.
- I. Casing:
 - 1. Jacket: Sheet metal, with snap-in or interlocking closures.
 - 2. Control Compartment Enclosures: NEMA 250, Type 1A.
 - 3. Finish: Baked-enamel protective finish.
 - 4. Insulation: Minimum 2-inch-thick, mineral-fiber insulation surrounding the heat exchanger.
 - 5. Combustion-Air Connections: Inlet and vent duct collars.
- J. Capacities and Characteristics:
 - 1. Minimum Efficiency: 94% AFUE
 - 2. Minimum Turn down: 5:1
 - 3. Refer to schedule on H-002 for more Boiler capacities & characteristics

2.3 TRIM

- A. Include devices sized to comply with ASME B31.1.
- B. Aquastat Controllers: Operating, firing rate, and high limit.
- C. Safety Relief Valve: ASME rated.

July 11, 2018

- D. Pressure and Temperature Gage: Minimum 3-1/2-inch-diameter, combination water-pressure and -temperature gage. Gages shall have operating-pressure and -temperature ranges, so normal operating range is about 50 percent of full range.
- E. Boiler Air Vent: Automatic.
- F. Drain Valve: Minimum NPS 3/4 hose-end gate valve.
- G. Circulation Pump: Non-overloading, in-line pump with split-capacitor motor having thermal-overload protection and lubricated bearings; designed to operate at specified boiler pressures and temperatures.

2.4 CONTROLS

- A. Boiler operating controls shall include the following devices and features:
 - 1. Control transformer.
 - 2. Set-Point Adjust: Set points shall be adjustable.
 - 3. Sequence of Operation: Electric, factory-fabricated and field-installed panel to control burner firing rate to maintain space temperature in response to thermostat with heat anticipator located in heated space.
 - a. Include automatic, alternating-firing sequence for multiple boilers to ensure maximum system efficiency throughout the load range and to provide equal runtime for boilers.
 - 4. Sequence of Operation: Electric, factory-fabricated and field-installed panel to control burner firing rate to reset supply-water temperature inversely with outside-air temperature. At 0 deg F outside-air temperature, set supply-water temperature at 180 deg F; at 60 deg F outside-air temperature, set supply-water temperature at 160 deg F.
 - a. Include automatic, alternating-firing sequence for multiple boilers to ensure maximum system efficiency throughout the load range and to provide equal runtime for boilers.
- B. Burner Operating Controls: To maintain safe operating conditions, burner safety controls limit burner operation.
 - 1. High Cutoff: Automatic reset stops burner if operating conditions rise above maximum boiler design temperature.
 - 2. Low-Water Cutoff Switch: Electronic probe shall prevent burner operation on low water. Cutoff switch shall be automatic-reset type.
 - 3. Blocked Inlet Safety Switch: Manual-reset pressure switch field mounted on boiler combustion-air inlet.
 - 4. Audible Alarm: Factory mounted on control panel with silence switch; shall sound alarm for above conditions.
- C. Building Automation System Interface: Factory install hardware and software to enable building automation system to monitor, control, and display boiler status and alarms.
 - 1. Hardwired Points:

- a. Monitoring: On/off status, common trouble alarm.
 - b. Control: On/off operation, hot-water-supply temperature set-point adjustment.
2. A communication interface with building automation system shall enable building automation system operator to remotely control and monitor the boiler from an operator workstation. Control features available, and monitoring points displayed, locally at boiler control panel shall be available through building automation system.

2.5 ELECTRICAL POWER

- A. Controllers, Electrical Devices, and Wiring: Electrical devices and connections are specified in electrical Sections.
- B. Single-Point Field Power Connection: Factory-installed and -wired switches, motor controllers, transformers, and other electrical devices necessary shall provide a single-point field power connection to boiler.
 1. House in NEMA 250, Type 1 enclosure.
 2. Wiring shall be numbered and color coded to match wiring diagram.
 3. Install factory wiring outside of an enclosure in a metal raceway.
 4. Field power interface shall be to nonfused disconnect switch.
 5. Provide branch power circuit to each motor and to controls with a disconnect switch or circuit breaker.
 6. Provide each motor with overcurrent protection.

2.6 VENTING KITS

- A. Kit: Complete system, ASTM A 959, Type AL29-4C stainless steel, pipe, vent terminal, thimble, indoor plate, vent adapter, condensate trap and dilution tank, and sealant. Installed in accordance with Manufacturers installation requirements.
- B. Combustion-Air Intake: Complete system, PVC, pipe, vent terminal with screen, inlet air coupling, and sealant. Installed in accordance with Manufacturers installation requirements.

2.7 SOURCE QUALITY CONTROL

- A. Burner and Hydrostatic Test: Factory adjust burner to eliminate excess oxygen, carbon dioxide, oxides of nitrogen emissions, and carbon monoxide in flue gas and to achieve combustion efficiency; perform hydrostatic test.
- B. Test and inspect factory-assembled boilers, before shipping, according to 2010 ASME Boiler and Pressure Vessel Code.

PART 3 - EXECUTION

3.1 BOILER INSTALLATION

- A. Equipment Mounting:
 - 1. Install boilers on cast-in-place concrete equipment base(s).
 - 2. Comply with requirements for vibration isolation and seismic-restraint devices specified in Section 230548 "Vibration and Seismic Controls for HVAC."
- B. Install gas-fired boilers according to NFPA 54.
- C. Assemble and install boiler trim.
- D. Install electrical devices furnished with boiler but not specified to be factory mounted.
- E. Install control wiring to field-mounted electrical devices.

3.2 CONNECTIONS

- A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to boiler to allow service and maintenance.
- C. Install piping from equipment drain connection to nearest floor drain. Piping shall be at least full size of connection. Provide an isolation valve if required.
- D. Connect piping to boilers, except safety relief valve connections, with flexible connectors of materials suitable for service. Flexible connectors and their installation are specified in Section 232116 "Hydronic Piping Specialties."
- E. Connect gas piping to boiler gas-train inlet with union. Piping shall be at least full size of gas-train connection. Provide a reducer if required.
- F. Connect hot-water piping to supply- and return-boiler tappings with shutoff valve and union or flange at each connection.
- G. Install piping from safety relief valves to nearest floor drain.
- H. Boiler Venting:
 - 1. Install flue venting kit and combustion-air intake. Boiler may not be commonly vented with any other gas fired equipment. Individual venting only. Combustion air intake must penetrate exterior wall and rise up a minimum of 4'-0" above grade.
 - 2. Connect full size to boiler connections.

3.3 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
 - 1. Perform installation and startup checks according to manufacturer's written instructions.
 - 2. Leak Test: Hydrostatic test. Repair leaks and retest until no leaks exist.
 - 3. Operational Test: Start units to confirm proper motor rotation and unit operation. Adjust air-fuel ratio and combustion.
 - 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 - a. Check and adjust initial operating set points and high- and low-limit safety set points of fuel supply, water level, and water temperature.
 - b. Set field-adjustable switches and circuit-breaker trip ranges as indicated.
- B. Boiler will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.
- D. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

3.4 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain boilers.

END OF SECTION

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SECTION 236200

PACKAGED COMPRESSOR AND CONDENSER UNITS
(FILED SUB-BID REQUIRED AS PART OF SECTION 23 00 01)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Sub-Bid Requirements: As provided under Section 23 00 01 – Heating, Ventilating and Air Conditioning Filed Sub-Bid Requirements and supplemented under the Bidding Requirements, Contract Forms, and Conditions of the Contract, and applicable parts of Division 1 - General Requirements.
 - 1. Work of this Filed Sub-Bid includes all individual specification sections listed in Section 23 00 01.

1.2 SUMMARY

- A. Section includes packaged, air-cooled, refrigerant compressor and condenser units.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For compressor and condenser units. Include plans, elevations, sections, details, and attachments to other work.
 - 1. Wiring Diagrams: For power, signal, and control wiring.

1.4 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. Fabricate and label refrigeration system according to ASHRAE 15, "Safety Standard for Refrigeration Systems."
- C. ASHRAE/IESNA 90.1 Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6, "Heating, Ventilating, and Air-Conditioning."

1.5 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of compressor and condenser units that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
 - a. Compressor failure.
 - b. Condenser coil leak.
2. Warranty Period: 10years from date of Substantial Completion.
3. Warranty Period (Compressor Only): Five years from date of Substantial Completion.
4. Warranty Period (Components Other Than Compressor): 10 years from date of Substantial Completion.
5. Warranty Period (Condenser Coil Only): Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 COMPRESSOR AND CONDENSER UNITS, AIR COOLED, 1 TO 5 TONS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Carrier
 2. Trane
 3. Johnson Controls/York
 4. Lennox
- B. Description: Factory assembled and tested; consisting of compressor, condenser coil, fan, motors, refrigerant reservoir, and operating controls.
- C. Compressor: Scroll, hermetically sealed, with rubber vibration isolators.
 1. Motor: Single speed, and includes thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.
 2. Two-Speed Compressor: Include manual-reset, high-pressure switch and automatic-reset, low-pressure switch.
 3. Accumulator: Suction tube.
- D. Refrigerant: R-410A
- E. Condenser Coil: Seamless copper-tube, aluminum-fin coil; circuited for integral liquid subcooler, with removable drain pan and brass service valves with service ports.
- F. Condenser Fan: Direct-drive, aluminum propeller fan; with permanently lubricated, totally enclosed fan motor with thermal-overload protection and ball bearings.
- G. Accessories:
 1. Coastal Filter: Mesh screen to protect condenser coil from salt damage.
 2. Crankcase heater.
 3. Cycle Protector: Automatic-reset timer to prevent rapid compressor cycling.
 4. Evaporator Freeze Thermostat: Temperature-actuated switch that stops unit when evaporator reaches freezing temperature.
 5. Filter-dryer.

6. High-Pressure Switch: Automatic-reset switch cycles compressor off on high refrigerant pressure.
 7. Liquid-line solenoid.
 8. Low-Pressure Switch: Automatic-reset switch cycles compressor off on low refrigerant pressure.
 9. PE mounting base.
 10. Precharged and insulated suction and liquid tubing.
 11. Sound Hood: Wraps around sound attenuation cover for compressor.
 12. Thermostatic expansion valve.
 13. Time-Delay Relay: Continues operation of evaporator fan after compressor shuts off.
- H. Unit Casing: Galvanized steel, finished with baked enamel; with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Mount service valves, fittings, and gage ports on exterior of casing.
- I. Capacities and Characteristics:
1. Refer to equipment schedule on drawing H-002 for capacities and characteristics.

2.2 COMPRESSOR AND CONDENSER UNITS, AIR COOLED, 6 TONS AND UP

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Carrier
 2. Trane
 3. Johnson Controls/York
 4. Lennox
- B. Description: Factory assembled and tested, air cooled; consisting of casing, compressors, condenser coils, condenser fans and motors, and unit controls.
- C. Compressor: Hermetic scroll compressor designed for service with crankcase sight glass, crankcase heater, and backseating service access valves on suction and discharge ports.
1. Capacity Control: Hot-gas bypass.
- D. Compressor: Hermetic or semihermetic rotary screw compressor designed for service with crankcase sight glass, crankcase heater, and backseating service access valves on suction and discharge ports.
1. Capacity Control: Hot-gas bypass.
- E. Refrigerant: R-410A
- F. Condenser Coil: Seamless copper-tube, aluminum-fin coil, including subcooling circuit and backseating liquid-line service access valve. Factory pressure test coils, then dehydrate by drawing a vacuum and fill with a holding charge of nitrogen or refrigerant.
- G. Condenser Fan: Propeller-type vertical discharge; either directly or belt driven. Include the following:

1. Permanently lubricated, ball-bearing motors.
2. Separate motor for each fan.
3. Dynamically and statically balanced fan assemblies.

H. Operating and safety controls include the following:

1. Manual-reset, high-pressure cutout switches.
2. Automatic-reset, low-pressure cutout switches.
3. Low-oil-pressure cutout switch.
4. Compressor-winding thermostat cutout switch.
5. Three-leg, compressor-overload protection.
6. Control transformer.
7. Magnetic contactors for compressor and condenser fan motors.
8. Timer to prevent excessive compressor cycling.

I. Accessories:

1. Gage Panel: Package with refrigerant circuit suction and discharge gages.
2. Hot-gas bypass kit.
3. Part-winding-start timing relay, circuit breakers, and contactors.

J. Unit Casings: Designed for outdoor installation with weather protection for components and controls and with removable panels for required access to compressors, controls, condenser fans, motors, and drives. Additional features include the following:

1. Steel, galvanized or zinc coated, for exposed casing surfaces; treated and finished with manufacturer's standard paint coating.
2. Perimeter base rail with forklift slots and lifting holes to facilitate rigging.
3. Gasketed control panel door.
4. Nonfused disconnect switch, factory mounted and wired, for single external electrical power connection.

K. Capacities and Characteristics:

1. Refer to equipment schedules on drawing H-002 for capacities and characteristics.

2.3 SOURCE QUALITY CONTROL

- A. Energy Efficiency: Equal to or greater than prescribed by ASHRAE/IESNA 90.1, "Energy Efficient Design of New Buildings except Low-Rise Residential Buildings," Section 6, "Heating, Ventilating, and Air-Conditioning."

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install units level and plumb, firmly anchored in locations indicated.
- B. Install roof-mounting units on equipment supports specified in Section 077200 "Roof Accessories."

C. Equipment Mounting:

1. Install compressor and condenser units on cast-in-place concrete equipment bases.
2. Comply with requirements for vibration isolation and seismic control devices specified in Section 230548 "Vibration and Seismic Controls for HVAC."
3. Comply with requirements for vibration isolation devices specified in Section 230548.13 "Vibration Controls for HVAC."

D. Maintain manufacturer's recommended clearances for service and maintenance.

E. Loose Components: Install electrical components, devices, and accessories that are not factory mounted.

3.2 CONNECTIONS

A. Comply with requirements for piping in Section 232113 "Hydronic Piping" and Section 232116 "Hydronic Piping Specialties." Drawings indicate general arrangement of piping, fittings, and specialties.

B. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.

C. Connect precharged refrigerant tubing to unit's quick-connect fittings. Install tubing so it does not interfere with access to unit. Install furnished accessories.

D. Connect refrigerant piping to air-cooled compressor and condenser units; maintain required access to unit. Install furnished field-mounted accessories. Refrigerant piping and specialties are specified in Section 232300 "Refrigerant Piping."

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test. Certify compliance with test parameters.
2. Leak Test: After installation, charge system with refrigerant and oil and test for leaks. Repair leaks, replace lost refrigerant and oil, and retest until no leaks exist.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor operation and unit operation, product capability, and compliance with requirements.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
5. Verify proper airflow over coils.

C. Verify that vibration isolation and flexible connections properly dampen vibration transmission to structure.

END OF SECTION 236200

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SECTION 237313.13

INDOOR, BASIC AIR-HANDLING UNITS
(FILED SUB-BID REQUIRED AS PART OF 23 00 01)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Sub-Bid Requirements: As provided under Section 23 00 01 – Heating, Ventilating and Air Conditioning Filed Sub-Bid Requirements and supplemented under the Bidding Requirements, Contract Forms, and Conditions of the Contract, and applicable parts of Division 1 - General Requirements.
 - 1. Work of this Filed Sub-Bid includes all individual specification sections listed in Section 23 00 01.

1.2 SUMMARY

- A. Section Includes: Factory-assembled, indoor air-handling units with limited features.

1.3 SUBMITTALS

- A. Product Data: For each air-handling unit.
 - 1. Unit dimensions and weight.
 - 2. Cabinet material, metal thickness, finishes, insulation, and accessories.
 - 3. Fans:
 - a. Certified fan-performance curves with system operating conditions indicated.
 - b. Certified fan-sound power ratings.
 - c. Fan construction and accessories.
 - d. Motor ratings, electrical characteristics, and motor accessories.
 - 4. Certified coil-performance ratings with system operating conditions indicated.
 - 5. Dampers, including housings, linkages, and operators.
 - 6. Filters with performance characteristics.
- B. Operation and maintenance manuals and information.

1.4 COORDINATION

- A. Coordinate sizes and locations of concrete bases with actual equipment provided.
- B. Coordinate sizes and locations of structural-steel support members, if any, with actual equipment provided.

PART 2 - PRODUCTS

2.1 PERFORMANCE 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. NFPA Compliance: Comply with NFPA 90A for design, fabrication, and installation of air-handling units and components.
- C. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."
- D. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."
- E. Structural Performance: Casing panels shall be self-supporting and capable of withstanding positive/negative 4-inch wg of internal static pressure, without exceeding a midpoint deflection of 0.005 inches/inch of panel span.

2.2 CAPACITIES AND CHARACTERISTICS

- A. Refer to equipment schedule on drawing H-002 For capacities & characteristics.

2.3 INDOOR, BASIC AIR-HANDLING UNIT MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Carrier Corporation; a unit of United Technologies Corp.
 - 2. Trane.
 - 3. YORK; a Johnson Controls company.

2.4 UNIT CASINGS

- A. General Fabrication Requirements for Casings:
 - 1. Forming: Form walls, roofs, and floors with at least two breaks at each joint.
 - 2. Joints: Sheet metal screws or pop rivets.
 - 3. Sealing: Seal all joints with water-resistant sealant. Hermetically seal at each corner and around entire perimeter.
 - 4. Base Rail:
 - a. Material: Galvanized steel.
 - b. Height: 4 inches.
- B. Double Wall:

1. Outside Casing Wall: Galvanized steel, minimum 18-gauge thick, with manufacturer's standard finish.
 2. Inside Casing Wall: Galvanized steel, solid, minimum 18-gauge thick.
 3. Floor Plate: Galvanized steel, treadplate, minimum 18-gauge thick.
 4. Casing Insulation:
 - a. Materials: Glass-fiber blanket or board insulation, Type I or Type II ASTM C 1071 or injected polyurethane foam insulation.
 - b. Insulation Thickness: 1 inch.
 - c. Thermal Break: Provide continuity of insulation with no through-casing metal in casing walls, floors, or roofs of air-handling unit.
- C. Static-Pressure Classifications:
1. For Unit Sections Upstream of Fans: Minus 2-inch wg.
 2. For Unit Sections Downstream and Including Fans: 2-inch wg.
- D. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
- E. Panels and Doors:
1. Panels:
 - a. Fabrication: Formed and reinforced with same materials and insulation thickness as casing.
 - b. Fasteners: Two or more camlock type for panel lift-out operation. Arrangement shall allow panels to be opened against airflow.
 - c. Gasket: Neoprene, applied around entire perimeters of panel frames.
 - d. Size: Large enough to allow unobstructed access for inspection and maintenance of air-handling unit's internal components. At least 18 inches wide by full height of unit casing up to a maximum height of 60 inches.
 2. Doors:
 - a. Fabrication: Formed and reinforced with same materials and insulation thickness as casing.
 - b. Hinges: A minimum of two ball-bearing hinges or stainless-steel piano hinge and two wedge-lever-type latches, operable from inside and outside. Arrange doors to be opened against airflow. Provide safety latch retainers on doors so that doors do not open uncontrollably.
 - c. Gasket: Neoprene, applied around entire perimeters of frame.
 - d. Size: Large enough to allow for unobstructed access for inspection and maintenance of air-handling unit's internal components. At least 18 inches wide by full height of unit casing up to a maximum height of 60 inches.
 3. Locations and Applications:
 - a. Fan Section: Doors.
 - b. Coil Section: Panels.
 - c. Access Section: Panels.
 - d. Access Sections Immediately Upstream and Downstream of Coil Sections: Panels.

- e. Damper Section: Panels.
 - f. Filter Section: Doors large enough to allow periodic removal and installation of filters.
 - g. Mixing Section: Panels.
- F. Condensate Drain Pans:
- 1. Construction:
 - a. Single-wall, stainless-steel sheet.
 - 2. Drain Connection:
 - a. Located at lowest point of pan and sized to prevent overflow. Terminate with threaded nipple on both ends of pan.
 - b. Minimum Connection Size: NPS 1.
 - 3. Slope: Minimum 0.125 in./ft. slope, to comply with ASHRAE 62.1, in at least two planes to collect condensate from cooling coils (including coil piping connections, coil headers, and return bends) and from humidifiers, and to direct water toward drain connection.
 - 4. Length: Extend drain pan downstream from leaving face for distance to comply with ASHRAE 62.1.
 - 5. Width: Entire width of water producing device.
 - 6. Depth: A minimum of 2 inches deep.

2.5 FAN, DRIVE, AND MOTOR SECTION

- A. Fan and Drive Assemblies: Statically and dynamically balanced and designed for continuous operation at maximum-rated fan speed and motor horsepower.
- 1. Shafts: With field-adjustable alignment.
 - a. Turned, ground, and polished hot-rolled steel with keyway. Ship with a protective coating of lubricating oil.
 - b. Designed to operate at no more than 70 percent of first critical speed at top of fan's speed range.
- B. Centrifugal Fan Housings: Formed- and reinforced-steel panels to form curved scroll housings with shaped cutoff and spun-metal inlet bell.
- 1. Bracing: Steel angle or channel supports for mounting and supporting fan scroll, wheel, motor, and accessories.
 - 2. Horizontal-Flanged, Split Housing: Bolted construction.
 - 3. Housing for Supply Fan: Attach housing to fan-section casing with metal-edged flexible duct connector.
 - 4. Flexible Connector: Factory fabricated with a fabric strip minimum 3-1/2 inches wide, attached to two strips of minimum 2-3/4-inchwide by 0.028-inch-thick, galvanized-steel sheet.
 - a. Flexible Connector Fabric: Glass fabric, double coated with neoprene. Fabrics, coatings, and adhesives shall comply with UL 181, Class 1.

- 1) Fabric Minimum Weight: 26 oz./sq. yd..
 - 2) Fabric Minimum Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
 - 3) Fabric Minimum Service Temperature Range: Minus 40 to plus 200 deg F.
- C. Plenum Fan Housings: Steel frame and panel; fabricated without fan scroll and volute housing. Provide inlet screens for Type SWSI fans.
- D. Forward-Curved, Centrifugal Fan Wheels: Inlet flange, backplate, and shallow blades with inlet and tip curved forward in direction of airflow and mechanically fastened to flange and backplate; steel hub swaged to backplate and fastened to shaft with setscrews.
- E. Airfoil, Centrifugal Fan Wheels (Plenum Fan Wheels): Smooth-curved inlet flange, backplate, and hollow die-formed airfoil-shaped blades continuously welded at tip flange and backplate; steel hub riveted to backplate and fastened to shaft with setscrews.
- F. Fan Shaft Bearings:
1. Self-aligning, pillow-block type with an L-50 rated life of minimum 100,000 hours according to ABMA 9.
- G. Belt Drives: Factory mounted, with adjustable alignment and belt tensioning, and with 1.5 service factor based on fan motor.
1. Pulleys: Cast iron or cast steel with split, tapered bushing; dynamically balanced at factory.
 2. Motor Pulleys: Adjustable pitch for use with 5-hp motors and smaller; fixed pitch for use with motors larger than 5 hp. Select pulley size so pitch adjustment is at the middle of adjustment range at fan design conditions.
 3. Belts: Oil resistant, nonsparking, and nonstatic; in matched sets for multiple-belt drives.
 4. Belt Guards: Comply with requirements specified by OSHA and fabricate according to SMACNA's "HVAC Duct Construction Standards"; 0.146-inch- thick, 3/4-inch diamond-mesh wire screen, welded to steel angle frame; prime coated.
- H. Discharge Dampers: Heavy-duty steel assembly with channel frame and sealed ball bearings, and opposed blades constructed of two plates formed around and welded to shaft, with blades linked out of airstream to single control lever.
- I. Internal Vibration Isolation and Seismic Control: Fans shall be factory mounted with manufacturer's standard restrained vibration isolation mounting devices having a minimum static deflection of 1 inch.
- J. Motor: Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."
1. Enclosure Type: Totally enclosed, fan cooled.
 2. NEMA Premium Efficient motors as defined in NEMA MG 1.
 3. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
 4. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in electrical Sections.
 5. Mount unit-mounted disconnect switches on exterior of unit.

2.6 COIL SECTION

A. General Requirements for Coil Section:

1. Comply with AHRI 410.
2. Fabricate coil section to allow removal and replacement of coil for maintenance and to allow in-place access for service and maintenance of coil(s).
3. Coils shall not act as structural component of unit.

B. Heating Coils:

1. Hot-Water Coils: Continuous circuit.
 - a. Piping Connections: Threaded, same end of coil.
 - b. Tube Material: Copper.
 - c. Fin Type: Plate.
 - d. Fin Material: Aluminum.
 - e. Fin and Tube Joint: Silver brazed.
 - f. Headers:
 - 1) Cast iron with cleaning plugs and drain and air vent tappings extended to exterior of unit.
 - 2) Seamless copper tube with brazed joints, prime coated.
 - 3) Fabricated steel, with brazed joints, prime coated.
 - 4) Provide insulated cover to conceal exposed outside casings of headers.
 - g. Frames: Channel frame, minimum 0.052-inch-thick galvanized steel.
 - h. Coil Working-Pressure Ratings: 200 psig, 325 deg F.

C. Cooling Coils:

1. Refrigerant Coil:
 - a. Tubes: Copper.
 - b. Fins:
 - 1) Material: Aluminum.
 - c. Fin and Tube Joints: Mechanical bond.
 - d. Headers: Seamless-copper headers with brazed connections.
 - e. Frames: Galvanized steel.
 - f. Ratings: Designed, tested, and rated according to ASHRAE 33 and AHRI 410.
 - 1) Working Pressure: Minimum 300 psig

2.7 AIR FILTRATION SECTION

A. Panel Filters:

1. Description: Pleated factory-fabricated, self-supported disposable air filters with holding frames.
2. Filter Unit Class: UL 900.
3. Media: Interlaced glass, synthetic, or cotton fibers coated with nonflammable adhesive.
4. Filter-Media Frame: High wet-strength beverage board with perforated metal retainer, or metal grid, on outlet side.

B. Side-Access Filter Mounting Frames:

1. Particulate Air Filter Frames: Match inner casing and outer casing material, and insulation thickness. Galvanized steel track.
 - a. Sealing: Incorporate positive-sealing device to ensure seal between gasketed material on channels to seal top and bottom of filter cartridge frames to prevent bypass of unfiltered air.

2.8 DAMPERS

A. General Requirements for Dampers: Leakage rate, according to AMCA 500, "Laboratory Methods for Testing Dampers for Rating," shall not exceed 4 cfm/sq. ft. at 1-inch wg and 8 cfm/sq. ft. at 4-inch wg.

B. Damper Operators: Comply with requirements in Section 230923.12 "Control Dampers."

C. Electronic Damper Operators:

1. Direct-coupled type designed for minimum 60,000 full-stroke cycles at rated torque.
2. Electronic damper position indicator shall have visual scale indicating percent of travel and 2- to 10-V dc, feedback signal.
3. Operator Motors:
 - a. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."
 - b. Size to operate with sufficient reserve power to provide smooth modulating action or two-position action.
 - c. Permanent Split-Capacitor or Shaded-Pole Type: Gear trains completely oil immersed and sealed. Equip spring-return motors with integral spiral-spring mechanism in housings designed for easy removal for service or adjustment of limit switches, auxiliary switches, or feedback potentiometer.
4. Nonspring-Return Motors for Dampers Larger Than 25 Sq. Ft.: Size for running torque of 150 in. x lbf and breakaway torque of 300 in. x lbf.
5. Spring-Return Motors for Dampers Larger Than 25 Sq. Ft.: Size for running and breakaway torque of 150 in. x lbf.
6. Size dampers for running torque calculated as follows:
 - a. Parallel-Blade Damper with Edge Seals: 7 inch-lb/sq. ft. of damper.
 - b. Opposed-Blade Damper with Edge Seals: 5 inch-lb/sq. ft. of damper.
 - c. Parallel-Blade Damper without Edge Seals: 4 inch-lb/sq. ft. of damper.
 - d. Opposed-Blade Damper without Edge Seals: 3 inch-lb/sq. ft. of damper.

- e. Dampers with 2- to 3-Inch wg of Pressure Drop or Face Velocities of 1000 to 2500 fpm: Increase running torque by 1.5.
 - f. Dampers with 3- to 4-Inch wg of Pressure Drop or Face Velocities of 2500 to 3000 fpm: Increase running torque by 2.0.
- 7. Coupling: V-bolt and V-shaped, toothed cradle.
 - 8. Overload Protection: Electronic overload or digital rotation-sensing circuitry.
 - 9. Fail-Safe Operation: Mechanical, spring-return mechanism with external, manual gear release on nonspring-return actuators.
 - 10. Power Requirements (Two-Position Spring Return): 24 V dc.
 - 11. Power Requirements (Modulating): Maximum 10 VA at 24 V ac or 8 W at 24 V dc.
 - 12. Proportional Signal: 2 to 10 V dc or 4 to 20 mA, and 2- to 10-V dc position feedback signal.
 - 13. Temperature Rating: Minus 22 to plus 122 deg F.
 - 14.
- D. Outdoor- and Return-Air Dampers: Low-leakage, double-skin, airfoil-blade, galvanized-steel dampers with compressible jamb seals and extruded-vinyl blade edge seals in opposed-blade arrangement with zinc-plated steel operating rods rotating in sintered bronze or nylon bearings mounted in a single galvanized-steel frame, and with operating rods connected with a common linkage. Leakage rate shall not exceed 4 cfm/sq. ft. at 1-inch wg and 8 cfm/sq. ft. at 4-inch wg.
- E. Mixing Section: Multiple-blade, air-mixer assembly located immediately downstream of mixing section.
- F. Combination Filter and Mixing Section:
- 1. Cabinet support members shall hold 2-inch- thick, pleated, flat, permanent or throwaway filters.
 - 2. Multiple-blade, air-mixer assembly shall mix air to prevent stratification, located immediately downstream of mixing box.
- 2.9 MATERIALS
- A. Steel:
- 1. ASTM A 36/A 36M for carbon structural steel.
 - 2. ASTM A 568/A 568M for steel sheet.
- B. Stainless Steel:
- 1. Manufacturer's standard grade for casing.
 - 2. Manufacturer's standard type, ASTM A 240/A 240M for bare steel exposed to airstream or moisture.
- C. Galvanized Steel: ASTM A 653/A 653M.
- D. Aluminum: ASTM B 209.

2.10 SOURCE QUALITY CONTROL

- A. AHRI 430 Certification: Air-handling units and their components shall be factory tested according to AHRI 430 and shall be listed and labeled by AHRI.
 - 1. AMCA 210 Compliance: Fan performance according to AMCA 210.
- B. AMCA 300 and AMCA 301, or AHRI 260 Certification: Air-handling unit fan sound ratings shall comply with AMCA 300, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data" and AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data," or with AHRI 260, "Sound Rating of Ducted Air Moving and Conditioning Equipment."
- C. Water Coils: Factory tested to 300 psig according to AHRI 410 and ASHRAE 33.
- D. Refrigerant Coils: Factory tested to minimum 450-psig internal pressure, and to minimum 300-psig internal pressure while underwater, according to AHRI 410 and ASHRAE 33.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Examine casing insulation materials and filter media before air-handling unit installation. Replace with new insulation materials and filter media that are wet, moisture damaged, or mold damaged.
- B. Equipment Mounting:
 - 1. Install air-handling units on cast-in-place concrete equipment bases.
 - 2. Comply with requirements for vibration isolation and seismic-control devices specified in Section 230548 "Vibration and Seismic Controls for HVAC."
- C. Arrange installation of units to provide access space around air-handling units for service and maintenance.
- D. Do not operate fan system until filters (temporary or permanent) are in place. Replace temporary filters used during construction and testing with new, clean filters.
- E. Connect duct to air-handling units with flexible connections. Comply with requirements in Section 233300 "Air Duct Accessories."

3.2 PIPING CONNECTIONS

- A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Where installing piping adjacent to air-handling unit, allow for service and maintenance.
- C. Connect piping to air-handling units mounted on vibration isolators with flexible connectors.

July 11, 2018

- D. Connect condensate drain pans using NPS 1-1/4, ASTM B 88, Type M copper tubing. Extend to nearest equipment or floor drain. Construct deep trap at connection to drain pan and install cleanouts at changes in direction.
- E. Hot-Water Piping: Comply with applicable requirements in Section 232113 "Hydronic Piping" and Section 232116 "Hydronic Piping Specialties." Install shutoff valve and union or flange at each coil supply connection. Install balancing valve and union or flange at each coil return connection.
- F. Refrigerant Piping: Comply with applicable requirements in Section 232300 "Refrigerant Piping." Install shutoff valve and union or flange at each supply and return connection.

3.3 ELECTRICAL CONNECTIONS

- A. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
- B. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."
- C. Install electrical devices furnished by manufacturer, but not factory mounted, according to NFPA 70 and NECA 1.
- D. Install nameplate for each electrical connection, indicating electrical equipment designation and circuit number feeding connection.
 - 1. Nameplate shall be laminated acrylic or melamine plastic signs, as specified in Section 260553 "Identification for Electrical Systems."
 - 2. Nameplate shall be laminated acrylic or melamine plastic signs with a black background and engraved white letters at least 1/2 inch high.

3.4 CONTROL CONNECTIONS

- A. Install control and electrical power wiring to field-mounted control devices.

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- C. Perform the following tests and inspections:
 - 1. Leak Test: After installation, fill water and steam coils with water, and test coils and connections for leaks.
 - 2. Charge refrigerant coils with refrigerant and test for leaks.
 - 3. Fan Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
- D. Air-handling unit or components will be considered defective if unit or components do not pass tests and inspections.

July 11, 2018

- E. Prepare test and inspection reports.

3.6 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain air-handling units.

END OF SECTION 237313.13

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Section 26 00 01
ELECTRICAL FILED SUB-BID REQUIREMENTS
(FILED SUB-BID REQUIRED)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. The BIDDING REQUIREMENTS, CONTRACT FORMS, and CONTRACT CONDITIONS as listed in the Table of Contents, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Work of this Section requires Filed Sub-Bids and is governed by the provisions of the Massachusetts General Laws (MGL), Public Bidding Law - Chapter 149, Sections 44A to 44J inclusive, as amended, and applicable Sections of the MGL, Public Contract Law - Chapter 30.
- C. Specification requirements for the Filed Sub-Bid "ELECTRICAL" includes all work of the following listed Specification Sections, in their entirety:
 - 1. Section 26 00 01 – Electrical Filed Sub-Bid Requirements
 - 2. Section 26 05 00 – General Conditions for Electrical Work
 - 3. Section 26 05 19 – Low-Voltage Electrical Power Conductors and Cables
 - 4. Section 26 05 26 – Grounding and Bonding for Electrical Systems
 - 5. Section 26 05 33 – Raceways and Boxes for Electrical Systems
 - 6. Section 26 24 16 – Panelboards
 - 7. Section 26 27 26 – Wiring Devices
 - 8. Section 26 28 13 – Fuses
 - 9. Section 26 28 16 – Enclosed Switches and Circuit Breakers
 - 10. Section 26 51 19 – LED Interior Lighting.
 - 11. Section 28 31 11 - Digital, Addressable Fire-Alarm System
- D. The work to be completed by the Filed Subcontractor for the work of this Section is shown on the following listed Drawings, not just those pertaining particularly to this Sub-Trade, unless specifically called out otherwise, regardless of where among the Drawings it appears:
 - G-001 TITLE SHEET
 - G-002 CODE SUMMARY, NOTES & DRAWING LIST
 - AD-101 EXISTING & SELECTIVE REMOVAL PLANS
 - A-100 BASEMENT PLAN
 - A-101 FIRST FLOOR PLAN
 - A-102 SECOND FLOOR PLAN
 - A-104 REFLECTIVE CEILING PLANS
 - A-501 KITCHEN ENLARGED PLAN & INTERIOR ELEVATIONS
 - E-001 ELECTRICAL LEGENDS, NOTES & ABBREVIATIONS
 - E-002 ELECTRICAL SCHEDULES
 - E-003 ELECTRICAL SCHEDULES AND DETAILS

- E-004 ELECTRICAL RISER DIAGRAM
- E-100 ELECTRICAL BASEMENT DEMOLITION PLAN
- E-101 ELECTRICAL FIRST FLOOR DEMOLITION PLAN
- E-102 ELECTRICAL SECOND FLOOR DEMOLITION PLAN
- E-200 ELECTRICAL BASEMENT NEW WORK PLAN
- E-201 ELECTRICAL FIRST FLOOR NEW WORK PLAN
- E-202 ELECTRICAL SECOND FLOOR NEW WORK PLAN
- FA-001 FIRE ALARM LEGEND AND RISER
- FA-100 FIRE ALARM BASEMENT PLAN
- FA-101 FIRE ALARM FIRST FLOOR PLAN
- FA-102 FIRE ALARM SECOND FLOOR PLAN

- E. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the Work of this Filed Subcontract.
- F. Filed Sub-Bids for work under this Section shall be for the complete work and shall be submitted electronically to the Awarding Authority at time, and in manner stipulated in the INVITATION TO BID and INSTRUCTIONS TO BIDDERS.
 - 1. Each Bid submittal for work under this Section shall be accompanied with the required bid deposit.
- G. Sub Sub-Bid Requirements: In accordance with Massachusetts General Law, Chapter 149, Section 44F, as amended, The Filed Sub-Bidder shall list in Paragraph E of the "Form for Sub-Bids" the name and bid price of each person, firm or corporation performing each class of work or part thereof for which the Section of the Specifications for that Sub-Trade require such listing.
 - 1. This filed trade requires that the following classes of work be listed in paragraph E under the conditions indicated herein.

Class Of Work	Reference Sections
a. Fire alarm	Section 28 31 11

1.2 EXAMINATION OF SITE AND DOCUMENTS

- A. 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 (Owner) will not be responsible for errors, omissions and/or charges for extra work arising from General Contractor's or Filed Subcontractor's failure to familiarize themselves with the Contract Documents or existing 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.

1.3 SEQUENCING

- A. Coordinate work of this Filed Subcontract with that of other trades, affecting or affected by this work, and cooperate with the other trades as is necessary to assure the steady progress of work.

July 11, 2018

- B. Do not order or deliver any materials until all schedules and submittals, required in the listed Specification Sections included as part of this Filed Subcontract, have been received and approved by the Architect.
- C. Before proceeding with installation work, inspect all project conditions and all work of other trades to assure that all such conditions and work are suitable to satisfactorily receive the work of this Section and notify the Architect in writing of any which are not. Do not proceed further until corrective work has been completed or waived.

PART 2 - PRODUCTS

2.1 SCAFFOLDS AND STAGING

- A. General: Filed Subcontractors shall obtain required permits for, and provide scaffolds, staging, and other similar raised platforms, required to access their Work as specified in Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS and herein.
 - 1. Scaffolding and staging required for use by this Filed Subcontractor pursuant to requirements of Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS shall be furnished, erected, maintained in a safe condition, and dismantled when no longer required, by this Filed Sub-Trade requiring such scaffolding.
 - 2. Each Filed Subcontractor is responsible to provide, maintain and remove at dismantling, all tarpaulins and similar protective measures necessary to cover scaffolding for inclement weather conditions other than those required to be provided, maintained and removed by the General Contractor pursuant to MGL (Refer to Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS and as additionally required for dust control).
 - 3. Furnishing portable ladders and mobile platforms of all required heights, which may be necessary to perform the work of this trade, are the responsibility this Filed Subcontractor.

2.2 HOISTING MACHINERY AND EQUIPMENT

- A. All hoisting equipment, rigging equipment, crane services and lift machinery required for the work by this Filed Subcontractor shall be furnished, installed, operated and maintained in safe conditions by this Filed Subcontractor, as referenced under Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS.

PART 3 - EXECUTION (Not Used)

End of Section

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Section 26 05 00

GENERAL CONDITIONS FOR ELECTRICAL WORK
(FILED SUB-BID REQUIRED AS PART OF SECTION 26 00 01)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Sub-Bid Requirements: As provided under Section 26 00 01 – Electrical Filed Sub-Bid Requirements and supplemented under the Bidding Requirements, Contract Forms, and Conditions of the Contract, and applicable parts of Division 1 - General Requirements.
 - 1. Work of this Filed Sub-Bid includes all individual specification sections listed in Section 26 00 01.

1.1 GENERAL PROVISIONS

A. RELATED DOCUMENTS

- 1. Where Paragraphs of this Section conflict with similar paragraphs of the General and Supplementary Conditions and DIVISION 01, requirements of this Section shall prevail.

B. REFERENCE DRAWINGS: THE WORK OF THIS SECTION IS SHOWN ON THE FOLLOWING CONTRACT DRAWINGS: E0.0, E1.0, E2.0.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor (including, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Provide all equipment as depicted on the Contract Drawings including:
 - a. Distribution panels
 - b. Meter Sockets
 - c. Fused Disconnect Switches
 - d. Fuses
 - e. New panelboards
 - f. Circuit breakers and all accessories for new panelboards
 - g. Receptacles
 - h. Wiring
 - i. Conduit
 - j. Luminaires and all associated equipment

- k. Telecommunications backboard, wiring, and associated equipment.
 - l. Grounding Equipment
 - m. Fire Alarm Control Panel
 - n. Fire Alarm Devices and all associated wiring and accessories.
 - o. All associated junction boxes, pull boxes, fittings, etc. that are necessary for the proper execution of the Work.
2. Demolition as depicted on the Drawings.
 3. Testing of all electrical systems.
 4. Coordination with other trades.
 5. All other systems hereinafter specified or indicated on the Contract Drawings, complete, leaving ready an electrical system in perfect operating condition.
 6. Coordination drawings and record drawings and similar requirements.
- B. Alternates: Not Applicable.

1.3 SUBMITTALS

- A. The requirements here supplement the requirements specified in DIVISION 01 for the work of DIVISION 26. These requirements cannot be waived without permission from the engineer.

B. RELATED DOCUMENTS

1. Consult the individual sections of the specifications for the specific submittals required under those sections and for further details and descriptions of the requirements.

C. GENERAL PROCEDURES FOR SUBMITTALS

1. Timeliness - The Contractor shall transmit each submittal to the Engineer sufficiently in advance of performing related Work or other applicable activities so that the installation is not delayed by processing times, including disapproval and resubmittal (if required), coordination with other submittals, testing, purchasing, fabrication, delivery, and similar sequenced activities. No extension of time will be authorized because of the Contractor's failure to transmit submittals to the Engineer in advance of the Work.
2. Sequence - The Contractor shall transmit each submittal in a sequence which will not result in the Engineer's approval having to be later modified or rescinded by reason of subsequent submittals which should have been processed earlier or concurrently for coordination.
3. Contractor's Review and Approval - Only submittals received from and bearing the stamp of approval of the Contractor will be considered for review by the Engineer. Submittals shall be accompanied by a transmittal notice stating name of Project, date of submittal, "To", "From" (Contractor, Contractor, Installer, Manufacturer, Supplier), Specification Section, or Drawing No. to which the submittal refers, purpose (first submittal, resubmittal), description, remarks, distribution record, and signature of transmitter.

4. Engineer's Action - The Engineer will review the Contractor's submittals and return them with one of the following actions recorded thereon by appropriate markings:
 - a. Final Unrestricted Release: Where marked "No Exceptions Taken" the Work covered by the submittal may proceed provided it complies with the requirements of the Contract Documents.
 - b. Final-But-Restricted Release: When marked "Make Corrections Noted" the Work may proceed provided it complies with the Engineer's notations or corrections on the submittal and complies with the requirements of the Contract Documents. Acceptance of the Work will depend on these compliances.
 - c. Returned for Resubmittal: When marked "Revise and Resubmit" or "Rejected and Resubmit" the Work covered by the submittal (such as purchasing, fabrication, delivery, or other activity) should not proceed. The submittal should be revised or a new submittal resubmitted without delay, in accordance with the Engineer's notations stating the reasons for returning the submittal.
- D. Processing - All costs for printing, preparing, packaging, submitting, resubmitting, and mailing, or delivering submittals required by this contract shall be included in the Contract Sum.
- E. OR EQUALS
 1. Definition - Whenever a specification section names one or more brands for a given item, and the Contractor wishes to submit, for consideration, another brand, the submission shall be considered an "or-equal" or a "material substitution". For the purposes of this Contract, the terms "or-equal" and "material substitution" shall be considered synonymous.
 2. In no case may an item be furnished on the Work other than the item named or described, unless the Engineer, with the Administrator's written concurrence, shall consider the item equal to the Item so named or described.
 3. The equality of items offered as "equal" to items named or described shall be proved to the satisfaction of the Engineer at the expense of the Contractor submitting the substitution.
- F. SUBMISSION OF PRODUCT DATA
 1. The Contractor shall submit 5 actual hard copies of Product Data to the Engineer. All such data shall be specific and identification of material or equipment submitted shall be clearly marked in ink. Data of general nature will not be accepted.
 2. Product Data shall be accompanied by a transmittal notice. The Contractor's stamp of approval shall appear on the printed information itself, in a location which will not impair legibility.
 3. Product Data returned by the Engineer as "Revise and Resubmit" or "Rejected and Resubmit" shall be resubmitted in 5 actual hard copies until the Engineer's approval is obtained.
 4. When the Product Data are acceptable, the Engineer will stamp them "No Exceptions Taken" or "Make Corrections Noted", retain 1 copy, and return 4 copies to the Contractor. The Contractor shall provide and distribute additional copies as may be

required to complete the Work.

5. The Contractor shall maintain one full set of approved, original, Product Data at the site.

G. SUBMISSION OF SHOP DRAWINGS

1. Shop Drawings shall be complete, giving all information necessary or requested in the individual section of the specifications. They shall also show adjoining Work and details of connection thereto.
2. Shop Drawings shall be for whole systems. Partial submissions will not be accepted.
3. The Engineer reserves the right to review and approve shop drawings only after approval of related product data and samples.
4. Shop drawings shall be properly identified and contain the name of the project, name of the firm submitting the shop drawings, shop drawing number, date of shop drawings and revisions, Contractor's stamp of approval, and sufficient spaces near the title block for the Engineer's stamp.
5. The Contractor shall submit to the Engineer five (5) black line prints of each shop drawing. Prints shall be mailed or delivered in roll form. Each submittal shall be accompanied by a transmittal notice bearing the Contractor's approval stamp.
6. In addition to the hard copies described above, the Engineer and Contractor may utilize a mutually acceptable electronic system to expedite the submittal process. This electronic system shall not be used as a substitute for the hard copy process.
7. When the Engineer returns a marked submittal with the stamp "Revise and Resubmit" or "Rejected and Resubmit", the Contractor shall correct the original drawing or prepare a new drawing and resubmit seven prints thereof to the Engineer for approval. This procedure shall be repeated until the Engineer's approval is obtained.
8. When the Engineer returns a submittal with the stamp "No Exceptions Taken" or "Make Corrections Noted", the Contractor shall provide and distribute the prints for all Contractor and Contractors use, and in addition submit, within 10 calendar days after approval, 4 prints to the Engineer.
9. The Contractor shall maintain one full set of approved shop drawings at the site.

1.4 REFERENCES

- A. Except where modified by a specific notation to the contrary, it shall be understood that the indication and/or description of any electrical item in the drawings or specifications for electrical work carries with it the instruction to furnish, install and connect the item as part of the electrical work, regardless of whether or not this instruction is explicitly stated.
- B. It shall be understood that the specifications and drawings for electrical work are complimentary and are to be taken together for a complete interpretation of the electrical work except that indications on the drawings, which refer to an individual element of work, take precedence over the specifications where they conflict with same.

1.5 REGULATORY REQUIREMENTS

- A. Comply with all applicable federal and state laws, and all local codes, by-laws and ordinances.
- B. Where provisions of the Contract Documents conflict with any codes, rules or regulations, the latter shall govern. Where the contract requirements are in excess of applicable codes, rules or regulations, the contract provisions shall govern unless the Engineer rules otherwise.
- C. Request inspections from authorities having jurisdiction, obtain all permits and pay for all fees and inspection certificates as applicable and/or required. All permits and certificates shall be turned over to the Owner's representative at the completion of the work. Copies of permits shall be given to the resident engineer prior to the start of work.
- D. Unless otherwise specified or indicated, materials and workmanship and equipment performance shall conform with the latest edition of the following standards, codes, specifications, requirements and regulations:
 - 1. State Building Code
 - 2. State Electrical Code
 - 3. National Fire Protection Association (NFPA)
 - 4. Local Town Regulations and By-laws
 - 5. Underwriter's Laboratories, Inc. (UL)
 - 6. National Electrical Manufacturer's Association (NEMA)
 - 7. American National Standards Institute (ANSI)
- E. All electrical work shall meet or exceed any other state and local codes and/or authorities having jurisdiction including all other standards indicated herein.

1.6 SURVEYS AND MEASUREMENTS

- A. Base all required measurements, both horizontal and vertical, on reference points established by the General Contractor and be responsible for the correct laying out of the electrical work. In the event of a discrepancy between actual measurements and those indicated, notify the General Contractor in writing, and do not proceed with the work required until written instructions have been issued by the General Contractor.

1.7 TYPICAL DETAILS

- A. Typical details where shown on the drawings shall apply to each and every item of the project where such items are applicable. They are not repeated in full on the drawings, which in many cases are diagrammatic only, but with the intention that such details shall be incorporated in full. Any alternate method proposed for use by the Contractor shall have the prior approval of the Engineer.

1.8 CORING, DRILLING

- A. Core, cut and/or drill all small holes 4.5" diameter or less in walls and floors required for the installation of sleeves and supports for the electrical work.

1.9 ACCESSIBILITY

- A. Install all work such that parts requiring periodic inspection, operation, maintenance and repair are readily accessible.
- B. Furnish all access panels appropriate to particular conditions, to be installed by trades having responsibility for the construction of actual walls, floors or ceilings at required locations.

1.10 TOOLS AND EQUIPMENT

- A. Provide all tools and equipment required for the fabrication and installation of the mechanical and electrical equipment at the site.

1.11 PORTABLE AND DETACHABLE PARTS

- A. Contractors shall retain in their possession all portable and/or detachable parts and portions of materials, devices, equipment etc. necessary for the proper operation and maintenance of the mechanical and electrical systems until final completion of the work, at which time they shall be handed over to Owner's representative.

1.12 RECORD DRAWINGS, PROJECT CLOSEOUT

- A. Comply with requirements specified in DIVISION 01.
- B. This trade shall submit the record set for approval by the fire and building departments in a form acceptable to the departments, when required by the jurisdiction.
- C. Drawings shall show record condition of details, sections, riser diagrams, control changes and corrections to schedules. Schedules shall show actual manufacturer and make and model numbers of final equipment installation.

1.13 GUARANTEE/WARRANTY

- A. Guarantee Work of this Section in writing for one year from substantial completion or owner acceptance. The guarantee shall repair or replace defective materials, equipment, workmanship and installation that develop within this period, promptly and to Engineer's satisfaction and correct damage caused in making necessary repairs and replacements under guarantee within Contract Price.
- B. In addition to guarantee requirements of DIVISION 01 and of Subparagraph A above, obtain written equipment and material warranties offered in manufacturer's published data without exclusion or limitation, in User Agency's name.
 - 1. Upon receipt of notice from Owner's representative of failure of any part of the systems or equipment during the warranty period, the affected part or parts shall be replaced by this Contractor without any reimbursement.
 - 2. At nine months into the one-year guarantee period, the contractor shall perform a 100% test of all installed equipment. Any device and/or part found to be defective shall be repaired and/or replaced at no cost to Owner. The Contractor shall notify the fire department one month in advance of the 100% test.
 - 3. Replace material and equipment that require excessive service during guarantee period as defined and as directed by Engineer.
 - 4. Provide 24 hour service beginning on the date the project is accepted by Owner, whether or not fully occupied, and lasting until the termination of the guarantee period. Service shall be at no cost to Owner. Service can be provided by this contractor or a

separate service organization. Choice of service organization shall be subject to Engineer and Owner's representative's approval. Submit name and a phone number that will be answered on a 24-hour basis each day of the week, for the duration of the service.

5. Submit copies of equipment and material warranties to Engineer before final payment.
6. At end of guarantee period, transfer manufacturers' equipment and material warranties still in force to User Agency.
7. This Paragraph shall not be interpreted to limit Owner's rights under applicable codes and laws and under this Contract.
8. Other sections of this Specification may specify warranty requirements that exceed those of this Paragraph. Those paragraphs will govern.
9. Use of systems provided under this Section for temporary services and facilities shall not constitute Final Acceptance of work by Owner's representative, and shall not initiate the guarantee period.
10. Non-durable items, such as electric lamps, shall be replaced up to the date of acceptance, such that they shall have had no more than 100 hours use prior to this date.
11. Provide manufacturer's engineering and technical staff at site to analyze and rectify problems that develop during guarantee period immediately. If problems cannot be rectified immediately to Owner's representative's satisfaction, advise Engineer in writing, describe efforts to rectify situation, and provide analysis of cause of problem. Engineer will direct course of action.

1.14 OPERATING, INSTRUCTION AND MAINTENANCE MANUALS

- A. Refer to DIVISION 01 for submittal procedures pertaining to operating and maintenance manuals.
- B. Each copy of the approved operating and maintenance manual shall contain copies of approved shop drawings, equipment literature, cuts, bulletins, details, equipment and engineering data sheets and typewritten instructions relative to the care and maintenance for the operation of the equipment, all properly indexed. Each manual shall have the following minimum contents:
 1. TABLE OF CONTENTS
 2. Introduction
 - a. Explanation of manual and its purpose and use.
 - b. Description of the electrical systems.
 - c. Safety precautions necessary for equipment.
 - d. Illustrations, schematics and diagrams.
 - e. Installation drawing.
 3. Maintenance

- a. Maintenance and lubricating instructions.
 - b. Replacement charts.
 - c. Trouble shooting charts for equipment components.
 - d. Testing instructions for each typical component.
 - e. Two typed sets of instructions for ordering spare parts. Each set shall include name, price, telephone number and address of where they may be obtained.
4. Manufacturer's Literature
- a. The equipment for which shop drawings have been submitted and approved.

1.15 QUALITY ASSURANCE

- A. The requirements of the State Building Code and local regulations establish the minimum acceptable quality of workmanship and materials, and all work shall conform thereto unless more stringent requirements are indicated or specified herein.
- B. All work shall comply with the latest editions of the codes as referenced herein.
- C. Follow manufacturer's directions for articles furnished, in addition to directions shown on drawings or specified herein.
- D. Protect all work, materials, and equipment from damage during process of work. Replace all damaged or defective work, materials and equipment without additional cost to Owner.
- E. All equipment and materials for permanent installation shall be the products of recognized manufacturers and shall be new.
- F. Equipment and materials shall:
 - 1. Where normally subject to Underwriters Laboratory Inc. listing or labeling services, be so listed or labeled.
 - 2. Be without blemish or defect.
 - 3. Not be used for temporary light and power purposes.
 - 4. Be in accordance with the latest applicable NEMA standards.
 - 5. Be products which will meet with the acceptance of all authorities having jurisdiction over the work. Where such acceptance is contingent upon having the products examined, tested and certified by Underwriters or other recognized testing laboratory, the product shall be so examined, tested and certified.
- G. Except for conduit, conduit fittings, outlet boxes, wire and cable, all items of equipment
DELIVERY, STORAGE AND HANDLING
- H. All materials for the work of this section shall be delivered, stored and handled so as to preclude damage of any nature. Manufactured materials shall be delivered and stored in their original containers, plainly marked with the products' and manufacturer's name.

Materials in broken containers or in packages showing watermarks or other evidence of damage, shall not be used and shall be removed from the site.

1.16 TEMPORARY POWER AND LIGHTING

- A. The Electrical Subcontractor shall furnish and install feeders of sufficient size from the Utility Company's power lines for the electric light and power requirements for the building while under construction and until the permanent feeders and related equipment have been installed and are in operation. Temporary lighting shall be based on a minimum of one watt per square foot covering each and every square foot of floor area in the building. Sufficient wiring, lamps, and outlets shall be installed to insure proper lighting in all rooms, space, stairwells, and corridors. Minimum sized lamp used shall be 100 watt. Where higher lighting intensities are required by Federal or State Standards of Laws or otherwise specified, the above specified wattage shall be increased to provide these increased intensities.
- B. All necessary transformers, meters, cables, panelboards, switches, temporary lamp replacements and accessories required for the temporary light and power installation shall be provided by the Electrical Subcontractor.
- C. The Electrical Subcontractor shall provide and maintain on each floor of the building, a feeder or feeders of sufficient capacity for the requirements of the entire floor and he shall provide a sufficient number of outlets, located at convenient points, so that extension cords of not over 50 ft. in length will reach all work requiring temporary light or power.
- D. The Electrical Subcontractor shall install and maintain the wiring and accessories for the offices of the General Contractor and Owner's representative as specified in the contract form.
- E. All temporary electrical work shall meet the requirements of the National Electrical Code Article 590 Temporary Installations, the Local Utility Company, and all Federal Standards and Laws.
- F. All temporary wiring and accessories thereto installed by the Electrical Subcontractor shall be removed after their purposes have been served.
- G. The General Contractor will pay for the cost of electric energy consumed by himself and by all of his Subcontractors, unless otherwise indicated.
- H. Provide all temporary lighting and power required above during the normal working hours of the project or a total of ten (10) hours per normal working day; Saturdays, Sundays and legal holidays are excluded. The ten hours per day shall include manning the temporary power and lighting 2 hour before and 2 hour after a normal eight (8) hour working day. In addition to the above, provide and maintain, to the satisfaction of the local authorities having jurisdiction, all temporary lighting and power that may be required for safety purposes. The Electrical Subcontractor will be compensated by the General Contractor for any additional standby time, materials or equipment required by the General Contractor or other Subcontractors beyond the normal working hours, as defined above.

1.17 PHASING, DEMOLITION AND MAINTAINING EXISTING SERVICES

- A. During the execution of the work, required relocation, etc., of existing equipment and systems in the existing building areas where new work is to be installed or new connections are scheduled to be made, shall be performed by the Electrical Subcontractor, as required by job conditions and as determined by the Engineer in the field, to facilitate the installation of the new system, while demolition, relocation work or new tie ins will be performed. Outages required for construction purposes shall be scheduled for the shortest practical periods of

- time, in coordination with the User Agency's designated representative, for specified, mutually agreeable periods of time, after each of which the interruption shall cease and the service shall be restored. This procedure shall be repeated to suit the User Agency's working schedule, as many times as required until all work is completed. Any outages of service shall be approved by Owner's representative, prior to commencing the work. No outages or shutdowns of service shall occur without the written authorization of the Owner's representative prior to commencing the work. Give notice of any scheduled shutdowns, a minimum of weeks in advance. User Agency shall make their best efforts to meet this request without adversely affecting the electric service to the existing building.
- B. Prior to any deactivation and relocation or demolition work, consult the drawings and arrange a conference with the Engineer and the Owner's representative in the field to inspect each of the items to be deactivated, removed or relocated. Care shall be taken to protect all equipment designated to be relocated and reused or to remain in operation and be integrated with the new systems.
- C. All deactivation, relocation and temporary tie ins of electrical systems and equipment shall be provided by the Electrical Subcontractor. All demolition and removal of electrical systems and equipment designed to be demolished shall be provided by the Electrical Subcontractor. Place all demolished electrical materials except hazardous materials (PCB lighting ballasts, fluorescent lamps, etc.) as determined by the Authority having jurisdiction in general contractors provided dumpster. All hazardous electrical materials shall be legally disposed by the electrical subcontractor.
- D. Owner's Representative reserves the right to inspect the material scheduled for removal and salvage any items he deems usable as spare parts.
- E. Phasing
1. The Electrical Subcontractor shall construct the subject project in phases as directed by the Engineer to suit the project progress schedule, as well as the completion date of the project.
 2. For additional information related to phasing, review the General Conditions and Supplementary Conditions and the Architectural drawings.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Product specifications are written in such a manner so as to specify what materials may be used in a particular location or application and therefore do not indicate what is not acceptable or suitable for a particular location or application. As an example: non-metallic sheathed cable is not specified; therefore, it is not acceptable.
- B. For purpose of establishing a standard of quality and not for purpose of limiting competition, the basis of this Specification is upon specified models and types of equipment and materials, as manufactured by specified manufacturers.
- C. In all cases, standard cataloged materials and systems have been selected. Materials such as lighting fixtures specially manufactured for this particular project and not part of a manufacturer's standard product line will, not be acceptable. In the case of systems, the system components shall be from a single source regularly engaged in supplying such systems. A proposed system made up of a collection of various manufacturers products will be unacceptable.

July 11, 2018

POPE'S TAVERN
ADDITION/RENOVATION
Halifax, Massachusetts

- D. Where Specifications list manufacturer's names and/or "as approved" or "Equal approved by Engineer", other manufacturers equipment will be considered if equipment meets Specification requirements and has all features of the specified items as are considered essential by Engineer.
- E. All materials shall be new and shall be UL listed.

End of Section

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Section 26 05 19

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES
(FILED SUB-BID REQUIRED AS PART OF SECTION 26 00 01)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Sub-Bid Requirements: As provided under Section 26 00 01 – Electrical Filed Sub-Bid Requirements and supplemented under the Bidding Requirements, Contract Forms, and Conditions of the Contract, and applicable parts of Division 1 - General Requirements.
 - 1. Work of this Filed Sub-Bid includes all individual specification sections listed in Section 26 00 01.

1.2 SUMMARY

- A. Section Includes:
 - 1. Building wires and cables rated 2000 V and less.
 - 2. Connectors, splices, and terminations rated 2000 V and less.

1.3 SUBMITTALS

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

PART 2 - PRODUCTS

2.1 Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- A. Southwire.
- B. Allied Wire and Cable
- C. General Cable

2.2 CONDUCTORS AND CABLES

- 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. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."
- C. Comply with UL 1277, UL 1685, and NFPA 70 for Type TC-ER cable used in VFC circuits.
- D. Conductors: Copper, complying with NEMA WC 70/ICEA S-95-658.
 - 1. Conductor Insulation: Comply with NEMA WC 70/ICEA S-95-658 for Type THHN/THWN-2.
- E. Cable: Comply with NEMA WC 70/ICEA S-95-658 for metal-clad cable, Type MC with ground wire.

2.3 CONNECTORS AND SPLICES

- A. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated; listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

- A. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

3.2 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. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."
- F. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly.

3.3 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-486B.
- B. Make splices, terminations, and taps that are compatible with conductor material.
 - 1. Use oxide inhibitor in each splice, termination, and tap for aluminum conductors.
- C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.

3.4 IDENTIFICATION

- A. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

3.5 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. Perform each of the following visual and electrical tests:

- a. Compare conductor and cable data with Drawings and Specifications.
 - b. Inspect exposed sections of conductor and cable for physical damage and correct connection according to the single-line diagram.
 - c. Test bolted connections for high resistance using one of the following:
 - 1) A low-resistance ohmmeter.
 - 2) Calibrated torque wrench.
 - 3) Thermographic survey.
 - d. Inspect compression applied connectors for correct cable match and indentation.
 - e. Inspect for correct identification.
 - f. Inspect cable jacket and condition.
 - g. Perform insulation-resistance test on each conductor with respect to ground and adjacent conductors. Apply a potential of 500-V dc for 300-V rated cable and 1000-V dc for 600-V rated cable for a one-minute duration.
 - h. Continuity test on each conductor and cable.
 - i. Uniform resistance of parallel conductors.
- B. Cables will be considered defective if they do not pass tests and inspections.
- C. Prepare Test and Inspection Reports: Prepare a written report to record the following:
- 1. Procedures used.
 - 2. Results that comply with requirements.
 - 3. Results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

End of Section

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Section 26 05 26

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS
(FILED SUB-BID REQUIRED AS PART OF SECTION 26 00 01)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Sub-Bid Requirements: As provided under Section 26 00 01 – Electrical Filed Sub-Bid Requirements and supplemented under the Bidding Requirements, Contract Forms, and Conditions of the Contract, and applicable parts of Division 1 - General Requirements.
 - 1. Work of this Filed Sub-Bid includes all individual specification sections listed in Section 26 00 01.

1.2 SUMMARY

- A. Section includes grounding and bonding systems and equipment.

PART 2 - PRODUCTS

2.1 Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- A. Southwire.
- B. Allied Wire and Cable
- C. General Cable

2.2 SYSTEM DESCRIPTION

- 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 UL 467 for grounding and bonding materials and equipment.

2.3 CONDUCTORS

- A. Insulated Conductors: 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.

2.4 CONNECTORS

- A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.

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. Conductor Terminations and Connections:
 - 1. Equipment Grounding Conductor Terminations: Bolted connectors.

3.2 EQUIPMENT GROUNDING

- A. Install insulated equipment grounding conductors with all feeders and branch circuits.

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.

End of Section

Section 26 05 33

RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS
(FILED SUB-BID REQUIRED AS PART OF SECTION 26 00 01)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Sub-Bid Requirements: As provided under Section 26 00 01 – Electrical Filed Sub-Bid Requirements and supplemented under the Bidding Requirements, Contract Forms, and Conditions of the Contract, and applicable parts of Division 1 - General Requirements.
 - 1. Work of this Filed Sub-Bid includes all individual specification sections listed in Section 26 00 01.

1.2 SUMMARY

- A. Section Includes:
 - 1. Metal conduits, tubing, and fittings.
 - 2. Boxes, enclosures, and cabinets.

1.3 SUBMITTALS

- A. Product Data: For raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

PART 2 - PRODUCTS

2.1 Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- A. Thomas and Betts.
- B. Republic Conduit.
- C. Allied Tube and Conduit.

2.2 CONDUITS, TUBING, AND FITTINGS

- A. Listing and Labeling: Conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. GRC: Comply with ANSI C80.1 and UL 6.
- C. EMT: Comply with ANSI C80.3 and UL 797.
- D. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.
- E. RNC: Rigid PVC Schedule 40 Conduit Complying with UL 651.
- F. Fittings: Comply with NEMA FB 1 and UL 514B.
 - 1. Fittings for EMT:

- a. Material: Steel.
- b. Type: Setscrew.
- 2. Expansion Fittings: match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.
- G. Joint Compound for IMC, GRC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.3 METAL WIREWAYS AND AUXILIARY GUTTERS

- A. Description: Sheet metal, complying with UL 870 and NEMA 250, Type 1 unless otherwise indicated, and sized according to NFPA 70.
- B. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

2.4 BOXES, ENCLOSURES, AND CABINETS

- A. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.
- B. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.
- C. Nonmetallic Outlet and Device Boxes: Comply with NEMA OS 2 and UL 514C.
- D. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

- A. Outdoors: Apply raceway products as specified below unless otherwise indicated:
 - 1. Exposed Conduit: GRC.
 - 2. Concealed Conduit, Aboveground: EMT.
 - 3. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.
 - 4. Underground: RNC. Sweeps turning up out of earth shall be GRC.
- B. Indoors: Apply raceway products as specified below unless otherwise indicated.
 - 1. Exposed: EMT.
 - 2. Concealed in Ceilings and Interior Walls and Partitions: EMT.
- C. Minimum Raceway Size: 3/4-inch trade size.
- D. Raceway Fittings: Compatible with raceways and suitable for use and location.
- E. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.

3.2 INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.
- 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. Arrange stub-ups so curved portions of bends are not visible above finished slab.
- D. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches of changes in direction.
- E. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.
- F. Support conduit within 12 inches of enclosures to which attached.
- G. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch trade size and insulated throat metal bushings on 1-1/2-inch trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.
- H. 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. Cap underground raceways designated as spare above grade alongside raceways in use.
- I. Surface Raceways:
 - 1. Install surface raceway with a minimum 2-inch radius control at bend points.
 - 2. Secure surface raceway with screws or other anchor-type devices at intervals not exceeding 48 inches and with no less than two supports per straight raceway section. Support surface raceway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.
- J. Install raceway sealing fittings at accessible locations according to NFPA 70 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.
- K. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:
 - 1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
 - 2. Where an underground service raceway enters a building or structure.
 - 3. Where otherwise required by NFPA 70.

July 11, 2018

POPE'S TAVERN
ADDITION/RENOVATION
Halifax, Massachusetts

3.3 PROTECTION

A. Protect coatings, finishes, and cabinets from damage and deterioration.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.

End of Section

Section 26 24 16

PANELBOARDS
(FILED SUB-BID REQUIRED AS PART OF SECTION 26 00 01)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Sub-Bid Requirements: As provided under Section 26 00 01 – Electrical Filed Sub-Bid Requirements and supplemented under the Bidding Requirements, Contract Forms, and Conditions of the Contract, and applicable parts of Division 1 - General Requirements.
 - 1. Work of this Filed Sub-Bid includes all individual specification sections listed in Section 26 00 01.

1.2 SUMMARY

- A. Section Includes:
 - 1. Distribution panelboards.
 - 2. Lighting and appliance branch-circuit panelboards.

1.3 DEFINITIONS

- A. MCCB: Molded-case circuit breaker.
- B. SPD: Surge protective device.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of panelboard.
- B. Shop Drawings: For each panelboard and related equipment.
 - 1. Include dimensioned plans, elevations, sections, and details.
 - 2. Detail enclosure types including mounting and anchorage, environmental protection, knockouts, corner treatments, covers and doors, gaskets, hinges, and locks.
 - 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. Include evidence of NRTL listing for SPD as installed in panelboard.
 - 7. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
 - 8. Include wiring diagrams for power, signal, and control wiring.
 - 9. Key interlock scheme drawing and sequence of operations.

10. Include time-current coordination curves for each type and rating of overcurrent protective device included in panelboards.

1.5 INFORMATIONAL SUBMITTALS

- A. Panelboard schedules for installation in panelboards.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

1.7 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to repair or replace panelboards that fail in materials or workmanship within specified warranty period.

PART 2 - PRODUCTS

2.1 PANELBOARDS COMMON 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. Comply with NEMA PB 1.
- C. Comply with NFPA 70.
- D. Enclosures: Surface-mounted, dead-front cabinets.
 1. Height: 79 inches maximum (to top of top-most switch.)
 2. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover. Trims shall cover all live parts and shall have no exposed hardware.

2.2 PERFORMANCE REQUIREMENTS

- A. Surge Suppression: Factory installed as an integral part of indicated panelboards, complying with UL 1449 SPD Type 1.

2.3 POWER PANELBOARDS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Eaton.
 2. Schneider Electric/Square D
 3. General Electric Company; GE Energy Management - Electrical Distribution.
 4. Siemens Industry, Inc., Energy Management Division.
- B. Panelboards: NEMA PB 1, distribution type.
- C. Branch Overcurrent Protective Devices: Bolt-on circuit breakers.

2.4 IDENTIFICATION

- A. Panelboard Label: Manufacturer's name and trademark, voltage, amperage, number of phases, and number of poles shall be located on the interior of the panelboard door.
- B. Breaker Labels: Faceplate shall list current rating, UL and IEC certification standards, and AIC rating.
- C. Circuit Directory: Typed Directory (with no hand written cross outs or corrections) inside panelboard door.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with NECA 1.
- B. Install panelboards and accessories according to NEMA PB 1.1.
- C. Mount panelboard cabinet plumb and rigid without distortion of box.
- D. Install overcurrent protective devices and controllers not already factory installed.
- E. Install filler plates in unused spaces.

3.2 IDENTIFICATION

- A. Panelboard Nameplates: Label each panelboard with an adhesive nameplate. Black with typed white writing.
- B. Install warning signs as required.

3.3 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Acceptance Testing Preparation:
 - 1. Test continuity of each circuit.
- C. Tests and Inspections:
 - 1. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

End of Section

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SECTION 26 27 26

WIRING DEVICES
(FILED SUB-BID REQUIRED AS PART OF SECTION 26 00 01)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Sub-Bid Requirements: As provided under Section 26 00 01 – Electrical Filed Sub-Bid Requirements and supplemented under the Bidding Requirements, Contract Forms, and Conditions of the Contract, and applicable parts of Division 1 - General Requirements.
 - 1. Work of this Filed Sub-Bid includes all individual specification sections listed in Section 26 00 01.

1.2 SUMMARY

- A. Section Includes:
 - 1. Straight-blade convenience receptacles.
 - 2. GFCI receptacles.
 - 3. Wall plates.

1.3 DEFINITIONS

1.4 SUBMITTALS

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

1.5 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

PART 2 - PRODUCTS

2.1 GENERAL WIRING-DEVICE REQUIREMENTS

- A. Wiring Devices, Components, 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 NFPA 70.
- C. Devices that are manufactured for use with modular plug-in connectors may be substituted under the following conditions:
 - 1. Connectors shall comply with UL 2459 and shall be made with stranding building wire.
 - 2. Devices shall comply with the requirements in this Section.
- D. Devices for Kitchen Equipment and Equipment Furnished by Others:
 - 1. Receptacles: Match plug configurations.

- E. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

2.2 STRAIGHT-BLADE RECEPTACLES

- A. Duplex Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and FS W-C-596
- B. Weather-Resistant and Tamper-Resistant Receptacles, 125 V, 15 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, and UL 498.

2.3 GFCI RECEPTACLES

- A. General Description:
 - 1. 125 V, 20 A, straight blade type.
 - 2. Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, UL 943 Class A, and FS W-C-596.
 - 3. Include indicator light that shows when the GFCI has malfunctioned and no longer provides proper GFCI protection.

2.4 TOGGLE SWITCHES

- A. Comply with NEMA WD 1, UL 20, and FS W-S-896.
- B. Switches, 120/277 V, 20 A.

2.5 COMBINATION TV AND TELEPHONE OUTLET:

- A. Description: Single RJ-45 jack for terminating 100-ohm, balanced, four-pair UTP; TIA/EIA-568; complying with Category 5e. Comply with UL 1863.

2.6 WALL PLATES

- A. Single and combination types shall match existing type and finish of existing wall plates.
- B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with Type 3R, weather-resistant thermoplastic with lockable, while-in-use cover.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.
- B. Coordination with Other Trades:
 - 1. Protect installed devices and their boxes. 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 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.
- C. Conductors:
1. Do not strip insulation from conductors until right 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. Pig tailing existing conductors is permitted, provided the outlet box is large enough.
- D. Device Installation:
1. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
 2. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
 3. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.
 4. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, two-thirds to three-fourths of the way around terminal screw.
 5. Use a torque screwdriver when a torque is recommended or required by manufacturer.
 6. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
 7. Tighten unused terminal screws on the device.
 8. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.
- E. Receptacle Orientation:
1. Install ground pin of receptacles to match existing receptacle orientation.

- F. 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.
- G. 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.
- H. GFCI Receptacles: Install non-feed-through-type GFCI receptacles where protection of downstream receptacles is not required.

3.2 FIELD QUALITY CONTROL

- A. Test Instruments: Use instruments that comply with UL 1436.
- B. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.
- C. Perform the following tests and inspections:
 - 1. Tests for Convenience Receptacles:
 - a. Line Voltage: Acceptable range is 105 to 132 V.
 - b. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is unacceptable.
 - c. Ground Impedance: Values of up to 2 ohms are acceptable.
 - d. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
 - e. Using the test plug, verify that the device and its outlet box are securely mounted.
 - f. 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.
- D. Wiring device will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.

End of Section

Section 26 28 13

FUSES
(FILED SUB-BID REQUIRED AS PART OF SECTION 26 28 13)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Sub-Bid Requirements: As provided under Section 26 00 01 – Electrical Filed Sub-Bid Requirements and supplemented under the Bidding Requirements, Contract Forms, and Conditions of the Contract, and applicable parts of Division 1 - General Requirements.
 - 1. Work of this Filed Sub-Bid includes all individual specification sections listed in Section 26 00 01.

1.2 SUMMARY

- A. Section Includes:
 - 1. Cartridge fuses rated 600 V ac and less for use in the following:
 - a. Enclosed switches.

1.3 ACTION SUBMITTALS

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

PART 2 - PRODUCTS

2.1 Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- A. Bussmann, an Eaton business.
- B. Edison; a brand of Bussmann by Eaton.
- C. Littlefuse, Inc.

2.2 CARTRIDGE FUSES

- A. Characteristics: NEMA FU 1, current-limiting, nonrenewable cartridge fuses with voltage ratings consistent with circuit voltages.
 - 1. Type RK-1: 600-V, zero- to 600-A rating, 200 kAIC.
- 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 NEMA FU 1 for cartridge fuses.
- D. Comply with NFPA 70.
- E. Coordinate fuse ratings with utilization equipment nameplate limitations of maximum fuse size and with system short-circuit current levels.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.
- B. Install spare-fuse cabinet(s) in location as indicated in the field by Owner.

3.2 IDENTIFICATION

- A. Install labels indicating fuse replacement information inside of door of each fused switch and adjacent to each fuse block, socket, and holder.

End of Section

SECTION 26 28 16

ENCLOSED SWITCHES AND CIRCUIT BREAKERS
(FILED SUB-BID REQUIRED AS PART OF SECTION 26 00 01)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Sub-Bid Requirements: As provided under Section 26 00 01 – Electrical Filed Sub-Bid Requirements and supplemented under the Bidding Requirements, Contract Forms, and Conditions of the Contract, and applicable parts of Division 1 - General Requirements.
 - 1. Work of this Filed Sub-Bid includes all individual specification sections listed in Section 26 00 01.

1.2 SUMMARY

- A. Section Includes:
 - 1. Fusible switches.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include nameplate ratings, dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.

1.4 WARRANTY

- A. Manufacturer's Warranty: Manufacturer and Installer agree to repair or replace components that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: 1 year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- A. Square D.
- B. Culter Hammer.
- C. General Electric.

2.2 GENERAL REQUIREMENTS

- A. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single manufacturer.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.

- C. Comply with NFPA 70.

2.3 FUSIBLE SWITCHES

- A. Type HD, Heavy Duty:

1. Single throw.
2. Three pole.
3. 600-V ac.
4. UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate specified fuses.
5. Lockable handle with capability to accept three padlocks, interlocked with cover in closed position.

- B. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
3. Isolated Ground Kit: Internally mounted; insulated, labeled for copper and aluminum neutral conductors.
4. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
5. Service-Rated Switches: Labeled for use as service equipment.

PART 3 - EXECUTION

3.1 INSTALLATION

- 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. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.
- C. Install fuses in fusible devices.
- D. Comply with NFPA 70 and NECA 1.

3.2 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
- B. Label each enclosure with engraved metal or laminated-plastic nameplate.

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections for Switches:

1. Visual and Mechanical Inspection:

- a. Inspect physical and mechanical condition.
- b. Inspect anchorage, alignment, grounding, and clearances.
- c. Verify that the unit is clean.
- d. Verify blade alignment, blade penetration, travel stops, and mechanical operation.
- e. Verify that fuse sizes and types match the Specifications and Drawings.
- f. Verify that each fuse has adequate mechanical support and contact integrity.
- g. Inspect bolted electrical connections for high resistance using one of the two following methods:
 - 1) Use a low-resistance ohmmeter.
 - a) Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from those of similar bolted connections by more than 50 percent of the lowest value.
 - 2) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data or NETA ATS Table 100.12.
 - a) Bolt-torque levels shall be in accordance with manufacturer's published data. In the absence of manufacturer's published data, use NETA ATS Table 100.12.
- h. Verify that operation and sequencing of interlocking systems is as described in the Specifications and shown on the Drawings.
- i. Verify correct phase barrier installation.
- j. Verify lubrication of moving current-carrying parts and moving and sliding surfaces.

2. Electrical Tests:

- a. Perform resistance measurements through bolted connections with a low-resistance ohmmeter. Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from adjacent poles or similar switches by more than 50 percent of the lowest value.
- b. Measure contact resistance across each switchblade fuseholder. Drop values shall not exceed the high level of the manufacturer's published data. If manufacturer's published data are not available, investigate values that deviate from adjacent poles or similar switches by more than 50 percent of the lowest value.

- c. Perform insulation-resistance tests for one minute on each pole, phase-to-phase and phase-to-ground with switch closed, and across each open pole. Apply voltage in accordance with manufacturer's published data. In the absence of manufacturer's published data, use Table 100.1 from the NETA ATS. Investigate values of insulation resistance less than those published in Table 100.1 or as recommended in manufacturer's published data.
- d. Measure fuse resistance. Investigate fuse-resistance values that deviate from each other by more than 15 percent.
- e. Perform ground fault test according to NETA ATS 7.14 "Ground Fault Protection Systems, Low-Voltage."

End of Section

Section 26 51 19

LED INTERIOR LIGHTING
(FILED SUB-BID REQUIRED AS PART OF SECTION 26 00 01)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Sub-Bid Requirements: As provided under Section 26 00 01 – Electrical Filed Sub-Bid Requirements and supplemented under the Bidding Requirements, Contract Forms, and Conditions of the Contract, and applicable parts of Division 1 - General Requirements.
 - 1. Work of this Filed Sub-Bid includes all individual specification sections listed in Section 26 00 01.

1.2 SUMMARY

- A. Section Includes:
 - 1. Interior solid-state luminaires that use LED technology.
 - 2. Lighting fixture supports.

1.3 DEFINITIONS

- A. CCT: Correlated color temperature.
- B. CRI: Color Rendering Index.
- C. Fixture: See "Luminaire."
- D. LED: Light-emitting diode.
- E. Lumen: Measured output of lamp and luminaire, or both.
- F. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product, arranged by designation.

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.

PART 2 - PRODUCTS

2.1 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.

2.2 MATERIALS

- A. Metal Parts:
 - 1. Free of burrs and sharp corners and edges.
 - 2. Sheet metal components shall be steel unless otherwise indicated.
 - 3. Form and support to prevent warping and sagging

2.3 METAL FINISHES

- A. Variations in finishes are unacceptable in the same piece. Variations in finishes of adjoining components are acceptable if they are within the range of approved Samples and if they can be and are assembled or installed to minimize contrast.

2.4 LUMINAIRE SUPPORT COMPONENTS

- A. Wires: ASTM A 641/A 641 M, Class 3, soft temper, zinc-coated steel, 12 gage.
- B. Rod Hangers: 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.

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.

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.
- B. Luminaire will be considered defective if it does not pass operation tests and inspections. Replace all defective luminaires (at no cost to the owner.)

End of Section

SECTION 28 31 11

DIGITAL, ADDRESSABLE FIRE-ALARM SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. The Work covered under this Section of the Specifications includes the following:

1. Notification Appliance Circuit Booster
2. Manual fire-alarm boxes.
3. Heat Detectors
4. System smoke detectors.
5. Carbon Monoxide Detectors
6. Notification appliances.

1.2 SUBMITTALS

A. Product Data: For each type of product, including furnished options and accessories.

B. Shop Drawings: For fire-alarm system.

1. Comply with recommendations and requirements in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.
2. Include voltage drop calculations for notification-appliance circuits.
3. Include statement from manufacturer that all equipment and components have been tested as a system and meet all requirements in this Specification and in NFPA 72.
4. Include performance parameters and installation details for each detector.

C. General Submittal Requirements:

1. Submittals shall be approved by authorities having jurisdiction prior to submitting them to Engineer.

1.3 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace fire-alarm system equipment and components that fail in materials or workmanship within specified warranty period.

1. Warranty Extent: All equipment and components not covered in the Maintenance Service Agreement.
2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

- 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.

2.2 SYSTEMS OPERATIONAL DESCRIPTION

- A. Fire-alarm signal initiation shall be by one or more of the following devices:

- 1. Manual stations.
- 2. Smoke detectors.
- 3. Heat Detectors.
- 4. Carbon Monoxide Detectors

- B. Fire-alarm signal shall initiate the following actions:

- 1. Continuously operate alarm notification appliances.
- 2. Notify the local fire department via radio master box.

2.3 NOTIFICATION APPLIANCE CIRCUIT BOOSTER

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:

- 1. Honeywell
- 2. System sensor
- 3. Simplex/Grinnell

- B. General Requirements for Notification Appliance Circuit Boosters:

- 1. Contractor to perform calculations to determine required capacity of NAC booster and associated batteries.

2.4 MANUAL FIRE-ALARM BOXES

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:

- 1. Honeywell
- 2. System Sensor
- 3. Simplex/Grinnell.

- B. General Requirements for Manual Fire-Alarm Boxes: Comply with UL 38.

2.5 SYSTEM SMOKE DETECTORS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - 1. Honeywell
 - 2. System sensor
 - 3. Simplex/Grinnell.
- B. General Requirements for System Smoke Detectors:
 - 1. Comply with UL 268; operating at 24-V dc, nominal.
 - 2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.
 - 3. Base Mounting: Detector and associated electronic components shall be mounted in a twist-lock module that connects to a fixed base. Provide terminals in the fixed base for connection to building wiring.
 - 4. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
 - 5. Integral Visual-Indicating Light: LED type, indicating detector has operated.
 - 6. Remote Control: Unless otherwise indicated, detectors shall be digital-addressable type, individually monitored at fire-alarm control unit for calibration, sensitivity, and alarm condition.

2.6 CARBON MONOXIDE DETECTORS

- A. Description: Listed for connection to fire-alarm system.
 - 1. Mounting: Adapter plate for outlet box mounting.
 - 2. Detector shall provide a means to test by introducing test carbon monoxide into the sensing cell.
 - 3. Detector shall provide alarm contacts and trouble contacts.
 - 4. Detector shall send trouble alarm when nearing end-of-life, power supply problems, or internal faults.
 - 5. Detector shall be listed to comply with UL 2075.
 - 6. Detectors shall be located, mounted, and wired according to manufacturer's written instructions.
 - 7. Test button simulates an alarm condition.

July 11, 2018

2.7 NOTIFICATION APPLIANCES

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - 1. Honeywell
 - 2. System Sensor
 - 3. Simplex/Grinnell.
- B. General Requirements for Notification Appliances: Connected to notification-appliance signal circuits, zoned as indicated, equipped for mounting as indicated, and with screw terminals for system connections.
 - 1. Combination Devices: Factory-integrated audible and visible devices in a single-mounting assembly, equipped for mounting as indicated, and with screw terminals for system connections.
- C. Horns: Electric-vibrating-polarized type, 24-V dc; with provision for housing the operating mechanism behind a grille. Comply with UL 464.
- D. Visible Notification Appliances: Xenon strobe lights complying with UL 1971, with clear or nominal white polycarbonate lens mounted on an aluminum faceplate.
 - 1. Mounting: Wall mounted unless otherwise indicated.
 - 2. Flashing shall be in a temporal pattern, synchronized with other units.
 - 3. Strobe Leads: Factory connected to screw terminals.
 - 4. Mounting Faceplate: Factory finished, red unless noted otherwise on plans.

PART 3 - EXECUTION

3.1 EQUIPMENT INSTALLATION

- A. Comply with NFPA 72, NFPA 101, and requirements of authorities having jurisdiction for installation and testing of fire-alarm equipment. Install all electrical wiring to comply with requirements in NFPA 70 including, but not limited to, Article 760, "Fire Alarm Systems."
- B. Manual Fire-Alarm Boxes:
 - 1. Install manual fire-alarm box in the normal path of egress within 60 inches of the exit doorway.
 - 2. Mount manual fire-alarm box on a background of a contrasting color.
 - 3. The operable part of manual fire-alarm box shall be between 42 inches and 48 inches above floor level. All devices shall be mounted at the same height unless otherwise indicated.

July 11, 2018

- C. Audible Alarm-Indicating Devices: Install not less than 6 inches below the ceiling. Install bells and horns on flush-mounted back boxes with the device-operating mechanism concealed behind a grille. Install all devices at the same height unless otherwise indicated.
- D. Visible Alarm-Indicating Devices: Install adjacent to each alarm bell or alarm horn and at least 6 inches below the ceiling. Install all devices at the same height unless otherwise indicated.

3.2 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 16075 Electrical Identification.
- B. Install framed instructions in a location visible from fire-alarm control unit.

3.3 FIELD QUALITY CONTROL

- A. Reacceptance Testing: Perform reacceptance testing to verify the proper operation of added or replaced devices and appliances.
- B. Fire-alarm system will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.
- D. Maintenance Test and Inspection: Perform tests and inspections listed for weekly, monthly, quarterly, and semiannual periods. Use forms developed for initial tests and inspections.

End of Section

Section 31 00 00
EARTHWORK

PART 1 - GENERAL

1.1 SPECIAL CONDITIONS

- A. The CONTRACTOR shall notify "Dig-Safe" in Massachusetts at 1-800-322-4844 and the Yarmouth Water Department, prior to any excavation. The "Dig-Safe" approval number shall be provided to the ENGINEER.

1.2 RELATED DOCUMENTS

- A. Drawings and Division 1 Specification Sections apply to work of this section.

1.3 DESCRIPTION OF WORK

- A. Furnish all labor, equipment, and materials to complete the work of this section, which includes but is not necessarily limited to the following:
 - 1. Earthwork for pavement and parking areas, and adjacent landscaped areas, including:
 - a. Excavation
 - b. Backfill
 - c. Grading and compaction
- B. Related Sections: The following Sections contain requirements that relate to this Section:
 - 1. Section 31 14 00 Earth Stripping and Stockpiling
 - 2. Section 32 12 00 "Asphalt Paving"
 - 3. -
 - 4. Section 33 41 00 Stormwater Drainage Systems"

1.4 DEFINITIONS

- A. Pavement Area: Pavement, parking, loading, and adjacent areas to a distance 1 foot in back of curb.
- B. Borrow: Soil material obtained off-site.
- C. Subgrade: The uppermost surface of an excavation, or the top surface of a fill or backfill, immediately below subbase, base, drainage fill, or topsoil materials.
- D. Subbase Course: The layer placed between the subgrade and base course in a paving system.
- E. Base Course: The layer placed between the subgrade or subbase and surface pavement in a paving system.
- F. Drainage Fill: Course of washed granular material supporting slab-on-grade placed to cut off upward capillary flow of pore water.

July 11, 2018

POPE'S TAVERN
ADDITION/RENOVATION
Halifax, Massachusetts

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- G. Unauthorized excavation consists of removing materials beyond indicated subgrade elevations or dimensions without direction by the ENGINEER. Unauthorized excavation, as well as remedial work directed by the ENGINEER, shall be at the CONTRACTOR's expense.
 - H. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below ground surface.

1.5 SUBMITTALS

- A. Comply with the pertinent provisions of Section 01 33 00 "Submittal Procedures"
- B. Product Data: Submit manufacturer's product data and installation instructions for each material and product used.
- C. Test Reports: Submit for approval test reports, list of materials and gradations proposed for use.
- D. Photographs of existing adjacent structures and site improvements.

1.6 QUALITY ASSURANCE

- A. Codes and Standards: Perform earthwork complying with requirements of authorities having jurisdiction.
- B. Comply with applicable requirements of NFPA 495--Explosive Materials Code.
- C. Testing and Inspection Service: OWNER will employ a qualified independent geotechnical engineering testing agency to classify proposed on-site and borrow soils to verify that soils comply with specified requirements and to perform required field and laboratory testing.
- D. Materials placed and compacted which do not conform to project specifications for the application shall be removed and replaced with suitable material as directed by the ENGINEER at no additional cost to the OWNER.

1.7 PROJECT CONDITIONS

- A. Existing Utilities: Do not interrupt existing utilities serving facilities occupied by the OWNER or others except when permitted in writing by the ENGINEER and then only after acceptable temporary utility services have been provided.
 - 1. Provide a minimum 72-hours' notice to the ENGINEER and receive written notice to proceed before interrupting any utility.

PART 2 – PRODUCTS

2.1 MATERIALS

- A. Granular fill below base course under pavement shall meet the following gradation requirements:

SIEVE SIZE	PERCENT FINER BY WEIGHT
3 inch	100
No. 10	30-95
No. 40	10-70
No. 200	0-8

B. Processed Gravel Base Course:

1. Processed gravel shall conform to Massachusetts DPW standard specifications, Section M1.03.1 and shall meet the following gradation requirements:

SIEVE SIZE	PERCENT FINER BY WEIGHT
2 inch	100
1 1/2 inch	70-100
3/4 inch	50-85
No. 4	30-60
No. 200	0-10

C. Bedding Sand:

1. Bedding sand shall be used for utility pipe bedding and initial backfill.
2. Bedding sand shall be free of silt, clay, loam, friable or soluble materials, organic matter, and frozen material, and shall meet the following gradation requirements:

SIEVE SIZE	PERCENT FINER BY WEIGHT
3/8 inch	100
No. 4	95-100
No. 8	80-100
No. 16	50-85
No. 30	25-60
No. 50	10-30
No. 100	2-10

3. On site sand may be used if tested and found to conform to the specifications above.

D. Common Fill

1. Common fill may be used for utility trench backfill above the bedding sand layer and for fills under pavements and pavers below the base material.
2. Common fill shall be clean sands and gravels free of silt, clay, loam, friable or soluble materials, frozen materials, and stones larger than 6" in maximum dimension, and shall conform to the following gradation requirements:
 - a. It shall be of such nature and character that it can be placed in embankments and compacted to the specified density in a reasonable length of time.
 - b. It shall be free from highly plastic clays, from all materials subject to decay, decomposition, or dissolution and from cinders or other materials which will corrode piping or other metals.
 - c. It shall have a maximum dry density of not less than 100 lbs. per cubic foot.

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- d. Material from excavation on the site may be used as common fill if it meets the above requirements, can be compacted to the specified densities, and is approved by the ENGINEER.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.
- B. Provide erosion control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

3.2 DEWATERING

- A. Prevent surface water, precipitation and subsurface or ground water from entering excavations, from ponding on prepared subgrades, and from flooding project site and surrounding area.
- B. Protect subgrades and foundation soils from softening and damage by rain or water accumulation.

3.3 CUTTING PAVEMENT

- A. Excavations made on pavement shall be made in a careful manner so as to cause the least amount of damage to the pavement. Bituminous concrete pavement shall be cut prior to trench excavation. Pavement and/or cement concrete will be cut 12 inches either side of the maximum allowable trench width. Any damage to the cut line due to the excavations, backfilling or removal of temporary pavement shall be recut to neat lines at no additional cost to the OWNER, prior to replacement of the specified finished pavement. The width of pavement removed shall be kept as narrow as practicable. Existing pavement and base course disturbed or damaged beyond the pavement lines indicated shall be replaced by the CONTRACTOR to match existing pavement and base course, at no additional cost to the OWNER.
- B. CONTRACTOR shall remove and dispose of existing bituminous concrete pavement off site as necessary to perform work of this contract as indicated. Removal of pavement shall be done in a neat manner by saw cutting a neat edge.
- C. Excavated pavement shall not be mixed with other excavated material which is to be used as backfill, and shall be removed immediately from the site of the work.

3.4 EXCAVATION

- A. Explosives: Do not use explosives.
- B. Unclassified Excavation: Excavation is unclassified and includes excavation to required subgrade elevations regardless of the character of materials and obstructions encountered.

July 11, 2018

3.5 STABILITY OF EXCAVATIONS

- A. Comply with all codes, ordinances, and requirements of authorities having jurisdiction to maintain stable excavations.

3.6 APPROVAL OF SUBGRADE

- A. Notify ENGINEER when excavations have reached required subgrade.
- B. When ENGINEER determines that unforeseen unsatisfactory soil is present, continue excavation and replace with systematically placed and compacted backfill or fill material as directed.
1. Unforeseen additional excavation and replacement material will be paid according to the Contract provisions for changes in Work.
- C. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by the ENGINEER at no cost to the OWNER.
- D. Soil Subgrades:
1. The area shall be stripped of topsoil/loess and excavated to the subgrade elevation. During excavation, unsuitable materials exposed at subgrade level, such as trash, peat, wood, logs, tree stumps, construction/building debris, topsoil, or other materials that may compress, decay, or collapse shall be removed.
 2. The entire area shall be proof-rolled using compaction equipment. During proof-rolling, locations that appear soft, exhibit excessive weaving, or are otherwise unstable, shall be excavated to firm material or a maximum depth of 18 in. These local excavations shall be refilled with systematically placed and compacted Engineered Fill.
- E. Compacted Fill Surfaces: Compacted Fill, or other fill materials, which become disturbed, contaminated with clay or otherwise unacceptable to the ENGINEER shall be removed and replaced with acceptable Fill at no additional cost to the OWNER.

3.7 STORAGE OF SOIL MATERIALS

- A. Stockpile excavated materials acceptable for backfill and fill soil materials, including acceptable borrow materials. Stockpile soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Provide erosion control measures around perimeter of stockpiles. Cover to prevent wind-blown dust.
1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.
 2. Establish soil and material stockpiles on site only at locations acceptable to the OWNER.

3.8 BACKFILL

- A. Backfill excavations promptly, but not before completing the following:
1. Acceptance of construction below finish grade.
 2. Surveying locations of underground utilities for record documents.
 3. Testing, inspecting, and approval of underground utilities.

July 11, 2018

4. Removal of trash and debris from excavation.
5. Removal of temporary shoring and bracing, and sheeting.

3.9 FILL

- A. Preparation: Remove vegetation, topsoil, debris, wet, and unsatisfactory soil materials, obstructions, and deleterious materials from ground surface prior to placing fills.
 1. Plow, scarify, strip, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing surface.
- B. When subgrade or existing ground surface to receive fill has a density less than that required for fill, break up ground surface to depth required, pulverize, moisture-condition or aerate soil, and recompact to required density.
- C. Place and compact fill material in layers to required elevations.

3.10 MOISTURE CONTROL

- A. Uniformly moisten, moisture condition, or aerate subgrade and each subsequent fill or backfill layer before compaction to within 2 percent of optimum moisture content.
 1. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.
 2. Remove and replace, or scarify and air-dry satisfactory soil material that is too wet to compact to specified density.
 - a. Stockpile or spread and dry removed wet satisfactory soil material.
- B. Wet Weather: If fill material placement, spreading, rolling, or compaction operations are interrupted by heavy rain or other unfavorable conditions, do not resume such operations until ascertaining that the moisture content and density of the previously-placed soil are as required by these specifications.

3.11 COMPACTION

- A. Place backfill and fill materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated compaction equipment.
- B. Place backfill and fill materials evenly on all sides of structures to required elevations. Place backfill and fill uniformly along the full length of each structure.
- C. Percentage of Maximum Dry Density Requirements: Compact soil to not less than the following percentages of maximum dry density according to ASTM D1557:
 1. Under Pavements and parking areas: compact the top 12 inches below excavated subgrade and each layer of backfill or fill material to 95 percent maximum dry density.
 2. Under lawn or unpaved areas, compact the top 6 inches below subgrade and each layer of backfill or fill material at 90 percent maximum dry density.
- D. Materials which are placed and compacted to less than the specified density shall be:

1. Recompacted as required to achieve specified density.
2. Removed and replaced with properly placed and acceptably compacted material.

E. Compaction by puddling is prohibited.

3.12 GRADING

A. General: Uniformly grade areas to a smooth surface, free from irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.

1. Provide a smooth transition between existing adjacent grades and new grades.
2. Cut out soft spots, fill low spots, and trim high spots to conform to required surface tolerances.

B. Site Grading: Slope grades to prevent ponding. Finish subgrades to required elevations within the following tolerances:

1. Lawn or Unpaved Areas: Plus or minus 0.10 foot.
2. Pavements: Plus or minus 0.05 foot.

3.13 SUBBASE AND BASE COURSES

A. Under pavements and parking areas, place subbase course material on prepared subgrades.

1. Compact subbase and base courses at optimum moisture content to required grades, lines, cross sections and thickness to not less than 95 percent of ASTM D 4254 relative density (the density specified in paragraph 3.11).
2. Shape subbase and base to required crown elevations and cross-slope grades.
3. When thickness of compacted subbase or base course is 6 inches or less, place materials in a single layer.
4. When thickness of compacted subbase or base course exceeds 6 inches, place materials in equal layers, with no layer more than 6 inches thick or less than 3 inches thick when compacted.

B. Pavement Shoulders: Place shoulders along edges of subbase and base course to prevent lateral movement. Construct shoulders at least 12 inches wide of acceptable soil materials and compact simultaneously with each subbase and base layer.

3.14 FIELD QUALITY CONTROL

A. Testing Agency Services: Allow testing agency to inspect and test each subgrade and each fill or backfill layer. Do not proceed until test results for previously completed work verify compliance with requirements.

B. When testing agency reports that subgrades, fills, or backfills are below specified density, scarify and moisten or aerate, or remove and replace soil to the depth required, recompact and retest until required density is obtained.

3.15 PROTECTION

- A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.
- B. Repair and re-establish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or lose compaction due to subsequent construction operations or weather conditions.
 - 1. Scarify or remove and replace material to depth directed by the ENGINEER; reshape and recompact at optimum moisture content to the required density.
- C. Settling: Where settling occurs within 1 year after project completion, remove finished surfacing, backfill with additional approved material, compact, and reconstruct surfacing.
 - 1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to the greatest extent possible.

3.16 MANAGEMENT AND DISPOSITION OF EXCAVATED SOIL AND FILL

- A. If contaminated or potentially contaminated soil is encountered, the Contractor shall stop excavating and notify the Construction Manager and Geotechnical Engineer.
- B. Perform excavation and material handling in a manner which limits mixing of different types of materials, i.e. asphalt, topsoil, construction debris, organic soils, soil fill, fill/boulders etc. General contractor responsible for coordinating testing and coordinating off-site disposal of excess soil in accordance with MassDEP regulations.
- C. No soil may be exported from the site without prior written approval from the Construction Manager. It is the intent that all granular soils excavated at the site will be reused on site below base course elevation to the extent possible. If soil deemed unsuitable for reuse by the Geotechnical Engineer or if a surplus of soil at the site is determined to be imminent by the Construction Manager then soil export will be considered. Off-site transportation and legal disposal of excess excavated materials shall be in accordance with local, state and federal regulations.

End of Section

July 11, 2018

POPE'S TAVERN
ADDITION/RENOVATION
Halifax, Massachusetts

SECTION 311400 – EARTH STRIPPING AND STOCKPILING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Provide facilities, labor, materials, tools, equipment, appliances, transportation, supervision, and related work necessary to complete the work specified in this section, and as shown on the Drawings.
- B. Work performed under this section of the specifications shall be subject to the General Conditions, Supplementary Conditions and Division 1 General Provisions of the Contract Documents.
- C. The work of this section includes but is not necessarily limited to:
 - 1. The removal, hauling and stockpiling of suitable excavated materials for subsequent use in the work. Stockpiling shall include protection to maintain materials in a workable condition.
 - 2. Re-handling, hauling and placing of stockpiled materials for use in refilling, filling, backfilling, grading and such other operations.
 - 3. Protect and preserve all existing buildings, pavements, and utilities to remain.
 - 4. Environmental controls.
 - 5. Obtain all required permits, licenses, and approvals of appropriate municipal and utility authorities, prior to commencing the work of this Section, and pay costs incurred therefrom.
 - 6. Providing products in sufficient quantities to meet the project requirements.
- D. Provide facilities, labor, materials, tools, equipment, appliances, and related work necessary to provide and maintain erosion control during construction operations. All erosion control measures shall be installed prior to earthwork operations and shall be maintained according to plans and other sections of the specifications.
- E. Contractor shall be responsible for notifying all affected utility companies and Dig Safe before starting work.

1.2 RELATED DOCUMENTS

- A. Carefully examine all of the Contract Documents for requirements which affect the work in this section. Other specification sections which directly relate to the work of this section include, but are not limited to, the following:

3. Section 312300 – Excavation and Fill

4. Section 312500 – Erosion Control

5. -

6. Local applicable Department of Public Works regulations.

1.3 LAWS AND REGULATIONS

- A. Work shall be accomplished in accordance with regulations of local, county and state agencies and national or utility company standards as they apply.

1.4 QUALITY ASSURANCE

- A. The Owner may retain and pay for the services of an independent testing and inspection firm and/or a Geotechnical Consultant to perform on-site observation and testing during the various phases of the construction operations. The scope of services will be determined by the Owner and the independent testing and inspection firm and/or the Geotechnical Consultant and will be provided to the contractor. The Owner reserves the right to modify or waive the services of the independent testing and inspection firm and/or the Geotechnical Consultant. The services of a Geotechnical Consultant/Inspection and testing firm may include, but not necessarily be limited to, the following:
1. Observation during excavation and dewatering of building and controlled fill areas.
 2. Observation of rock removal and blasting operations.
 3. Observation of foundation subgrades.
 4. Laboratory testing and analysis of fill materials as specified herein and proposed by the Contractor for incorporation into the Work.
 5. Observation of construction and performance of water content, gradation and compaction tests at a frequency and locations that he shall select. The results of these tests will be submitted to the Owner, Engineer, and Contractor on a timely basis so that action can be taken to remedy indicated deficiencies. During the course of construction, the Geotechnical Consultant will advise the Owner in writing if at any time in his opinion the Work hereunder is of unacceptable quality. Failure of Geotechnical Consultant to give notice, shall not excuse the Contractor from latent defects discovered in his work.
- B. The Contractor shall make provisions for allowing observations and testing of Contractor's Work by the independent testing and inspection firm and/or the Geotechnical Consultant.
- C. The presence of the independent testing and inspection firm and/or the Geotechnical Consultant does not include supervision or direction of the actual work of the Contractor, his employees or agents. Neither the presence of the independent testing and inspection firm and /or the Geotechnical Consultant, nor any observations and testing performed by them, nor failure to give notice of defects shall excuse the Contractor from defects discovered in his work.

July 11, 2018

POPE'S TAVERN
ADDITION/RENOVATION
Halifax, Massachusetts

- D. Costs related to retesting due to unacceptable qualities of work and failures discovered by testing shall be paid for by the Contractor at no additional expense to Owner, and the costs thereof will be deducted by the Owner from the Contract Sum.
- E. Whenever floodplain compensation areas are designated on the plans, grading elevations are to be considered critical to the floodplain volumetric calculations and shall be constructed by the Contractor in strict conformance with the indicated grades.

1.5 SUBMITTALS

- A. For use of fabrics or geogrids, submit manufacturer's literature for approval by the Engineer.

1.6 COORDINATION

- A. Prior to start of earthwork the Contractor shall arrange an on-site meeting with the Engineer, the independent testing firm, and the Geotechnical Consultant for the purpose of establishing the Contractor's schedule of operations and scheduling observation and testing procedures and requirements.
- B. As construction proceeds, the Contractor shall be responsible for notifying the Engineer prior to the start of earthwork operations requiring observation and/or testing.

1.7 SUBSURFACE SOIL DATA

- A. N/A
- B. Review available logs of borings, jar soil samples, records of explorations and other pertinent data for the site. After obtaining Owner's permission, take whatever additional subsurface explorations deemed necessary at no expense to the Owner.
- C. Jar soil samples may be examined upon written request to the Geotechnical Engineer.
- D. The above data are for general information and are accurate only at the particular locations and times the subsurface explorations were made. It is the Contractor's responsibility to make interpretations and to draw conclusions based on the character of materials to be encountered and the impact on his work based on his expert knowledge of the area and of earthwork techniques.
- E. The Drawings in the geotechnical report showing existing ground elevations are only for whatever use the Contractor may make of them with no responsibility on the part of the Engineers, Surveyors, the Owner, and/or their Representatives for the accuracy and/or the reliability of the information given.
- F. If a potential conflict exists between the Geotechnical Report and these technical specifications, the Contractor shall, immediately upon its discovery, request clarification from the Owner's Representative.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Filter Fabric/Geotextiles

1. Geotextile Fabric shall be used to prevent soil intrusion into drains and/or assist in stabilizing soil subgrades to be laid on approved soil subgrades prior to placement of fill materials.
 - i. Contractor shall use TenCate Mirafi® 140N or equivalent filter fabric in drainage recharge systems, underdrain systems between crushed stone and granular soils, leaching areas or where indicated on the plans.
 - ii. Contractor shall use TenCate Mirafi® 160N or 180N or equivalent non-woven geotextile in drainage recharge systems as the separation layer between angular stone cover and fill to prevent fines intrusion and as the filter layer over the chambers of the StormTech Isolator Row. (Stormtech – AASHTO M288 Class 2 Non-Woven suitable geotextile)
 - iii. Contractor shall use TenCate Mirafi® 600X or equivalent woven geotextile in drainage recharge systems as the stabilization layer for the angular stone foundation of the Stormtech Isolator Row and at each inlet row. (Stormtech – AASHTO M288 Class 1 Woven suitable geotextile)

2.2 USE OF MATERIALS

- A. Use of materials shall be as described below and as shown on the plans. Further details can be found in the project plans. Combinations or layering of materials may be necessary in certain instances such as for detention embankments, subsurface disposal areas, and riprap walls as examples.
 1. Filter Fabric/Geotextiles: To be used as filter barriers between drainage recharge systems, underdrain systems, wastewater absorption systems, and between natural earth material and backfill or other materials to assist in stabilizing soil subgrades.

PART 3 - EXECUTION

3.1 CLEARING AND GRUBBING

- A. Cut and remove trees as noted on landscape plans, remove stumps and brush. Legally dispose of off-site.
- B. Woodwastes may be chipped and shredded on-site and reused on-site with permission of the Engineer.
- C. Strip all topsoil, subsoil and other unsuitables to its full depth within the Contract limits. In building areas, limits of excavation are defined in Section 3.03 B.
- D. Under pavement areas, unsuitable materials shall be removed and disposed of by the Contractor in an Approved location, or if no Approved location exists on site to an Approved off site location and replaced with structural fill. Treatment of existing fill and removal of topsoil, subsoil and stumps are defined in Section 3.03 B.8. These materials shall be processed to remove all roots, stones larger than 3/4 inch in diameter and other deleterious materials. Stockpile as approved by the Engineer. Protect the topsoil from contamination by other materials.

July 11, 2018

POPE'S TAVERN
ADDITION/RENOVATION
Halifax, Massachusetts

- E. Other Specification sections shall apply to clearing and grubbing under demolition and shall include air quality, erosion control and hazardous waste.
- F. Remove all topsoil, subsoil, vegetative matter, and non-soil materials and, after screening out the roots, rocks greater than $\frac{3}{4}$ inch in size, and deleterious debris, separately stockpile the topsoil and subsoil materials.

END OF SECTION

July 11, 2018

POPE'S TAVERN
ADDITION/RENOVATION
Halifax, Massachusetts

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SECTION 312300 – EXCAVATION AND FILL

PART 1 - GENERAL

1.1 GENERAL

- A. Drawings and Work performed under this section of the specifications shall be subject to the General Conditions, Supplementary Conditions and Division 1 General Provisions of the Contract Documents.
- B. Examine all Drawings and all other Sections of the Specifications for requirements which affect work of this Section whether or not such work is specifically mentioned in this Section.
- C. Coordinate work with that of all other trades or contracts affecting or affected by work of this Section. Cooperate with such trades to assure the steady progress of all work under the Contract.

1.2 DESCRIPTION

- A. Provide facilities, labor, materials, tools, equipment, appliances, transportation, supervision, and related work necessary to complete the work specified in this section, and as shown on the Drawings.
- B. Excavation and Replacement of Unsuitables consists of the removal of existing foundations and structures, existing fill and organic soils to natural granular or glacial till soils or bedrock and replacement with compacted Structural/Granular Fill.
- C. Contamination associated with environmental conditions at the Site may become evident during construction, especially in the northwestern portion of the Site. In the event that contaminated soil or groundwater is encountered, construction activities should cease in the area until the condition is further evaluated and a plan for addressing this condition has been formulated. The work of this section includes but is not necessarily limited to:
 - 1. Fine grading and compaction of pavement subgrade.
 - 2. Furnishing, placing and compacting of subbase and base materials.
 - 3. Excavation, fill, and backfill, as indicated or required, including compaction.
 - 4. Excavation, as required, to the lines and grades indicated on the Drawings. Excavate all materials, including soil, boulders, abandoned utilities, existing building foundations, pavements, curbs, granite blocks, and all other materials as necessary to construct the improvements shown on the Drawings.
 - 5. Excavation and offsite disposal of unsuitable or excess materials unless on-site locations are designated. Excavation shall include removal and satisfactory disposal of all unclassified material encountered throughout the site. Removal (if necessary) of all excess excavated material shall be performed in accordance with all local, state, and federal regulations.
 - 6. Rough grading, including placement, moisture conditioning and compaction of fills and backfill.

7. Prepare, grade, shape, compact and protect all subgrades, backfills, and ground surfaces as shown on the Drawings.
8. Placement of base and subbase course materials under structures, pavements, slabs and footings, including compaction.
9. Trench excavation, bedding and backfill for structures, foundations, and utilities, including compaction.
10. Densification of the existing fill subgrade within proposed pavement areas.
11. The removal, hauling and stockpiling of suitable excavated materials for subsequent use in the work. Stockpiling shall include protection to maintain materials in a workable condition.
12. Rehandling, hauling and placing of stockpiled suitable excavated materials for use in refilling, filling, backfilling, grading and such other operations.
13. Furnishing and installing all sheeting, shoring, and bracing of structural and trench excavations and its satisfactory removal, unless otherwise directed to have it remain in place.
14. Protect and preserve all existing buildings, pavements, and utilities to remain. Excavation shall not intersect the 1 horizontal to 1 vertical (1H:1V) bearing zone under existing utilities or building foundations to remain.
15. Environmental controls.
16. Obtain all required permits, licenses, and approvals of appropriate municipal and utility authorities, prior to commencing the work of this Section, and pay costs incurred therefrom.
17. Providing adequate pumping and drainage facilities to keep the work area sufficiently dry. More significant dewatering is anticipated with the excavation and replacement of Unsuitables.
18. Providing products in sufficient quantities to meet the project requirements.
19. Control airborne dust to below visible levels.
20. Control odors emanating from soil during excavation (e.g. organic soils).
21. No soil or processed fill shall be brought onto the site without prior approval from the Owner.
22. It is hereby understood that the Contractor has carefully examined the site and all conditions affecting work under this Section. No claim for additional costs will be allowed because of a lack of knowledge of existing conditions as indicated in the Contract Documents, or obvious from observation of the site.

23. Segregate, handle, stockpile, manage, and reuse suitable excavated materials as specified in Contract Documents.

- D. Provide facilities, labor, materials, tools, equipment, appliances, and related work necessary to provide and maintain erosion control during construction operations. All erosion control measures shall be installed prior to earthwork operations and shall be maintained according to plans and other sections of the specifications.
- E. Contractor shall be responsible for notifying all affected utility companies and Dig Safe before starting work.

1.3 RELATED DOCUMENTS

- A. Carefully examine all of the Contract Documents for requirements which affect the work in this section. Other specification sections which directly relate to the work of this section include, but are not limited to, the following:
 - 1. -
 - 2. -
 - 3. Section 311400 – Earth Stripping and Stockpiling
 - 4. Section 312500 – Erosion Control

1.4 LAWS AND REGULATIONS

- A. Work shall be accomplished in accordance with regulations of local, county and state agencies and national or utility company standards as they apply.

1.5 QUALITY ASSURANCE

- A. The Owner may retain and pay for the services of an independent testing and inspection firm and/or a Geotechnical Consultant to perform on-site observation and testing during the various phases of the construction operations. The scope of services will be determined by the Owner and the independent testing and inspection firm and/or the Geotechnical Consultant and will be provided to the contractor. The Owner reserves the right to modify or waive the services of the independent testing and inspection firm and/or the Geotechnical Consultant. The services of a Geotechnical Consultant/Inspection and testing firm may include, but not necessarily be limited to, the following:
 - 1. Observation during excavation and dewatering of building, utility and controlled fill areas.
 - 2. Observation of rock removal and blasting operations.
 - 3. Observation of foundation subgrades.

4. Laboratory testing and analysis of fill and backfill materials submitted as specified herein and proposed by the Contractor for incorporation into the Work.
 5. Observation of below-grade construction and performance of water content, gradation and compaction tests on fill or backfill materials at a frequency and locations that he shall select. The results of these tests will be submitted to the Owner, Engineer, and Contractor on a timely basis so that action can be taken to remedy indicated deficiencies. During the course of construction, the Geotechnical Consultant will advise the Owner in writing if at any time in his opinion the Work hereunder is of unacceptable quality. Failure of Geotechnical Consultant to give notice, shall not excuse the Contractor from latent defects discovered in his work.
- B. The Contractor shall make provisions for allowing observations and testing of Contractor's Work by the independent testing and inspection firm and/or the Geotechnical Consultant.
 - C. The presence of the independent testing and inspection firm and/or the Geotechnical Consultant does not include supervision or direction of the actual work of the Contractor, his employees or agents. Neither the presence of the independent testing and inspection firm and /or the Geotechnical Consultant, nor any observations and testing performed by them, nor failure to give notice of defects shall excuse the Contractor from defects discovered in his work.
 - D. The presence of the Geotechnical Consultant shall not relieve the Contractor of its responsibility to perform the Work in accordance with the Contract Documents, nor shall it be construed to relieve the Contractor from full responsibility for the means and methods of construction, protection of site improvements against damage, and for safety on the construction site.
 - E. Costs related to retesting due to unacceptable qualities of work and failures discovered by testing shall be paid for by the Contractor at no additional expense to Owner, and the costs thereof will be deducted by the Owner from the Contract Sum.
 - F. Work not in conformance with the specified requirements shall be improved, or removed and replaced, at no additional cost to the Owner. All costs related to testing of nonconforming Work or materials shall be paid for by the Contractor at no additional cost to the Owner.
 - G. Whenever floodplain compensation areas are designated on the plans, grading elevations are to be considered critical to the floodplain volumetric calculations and shall be constructed by the Contractor in strict conformance with the indicated grades.
 - H. Tolerances
 1. Construct finished soil and backfill surfaces to +/- 1/2 in. of the grades and elevations indicated on the Drawings.
 2. Maintain the moisture content of fill material as it is being placed to levels that allow for compaction to the specified degree of compaction.

1.6 SUBMITTALS

- A. Submit, in an airtight container for the testing laboratory, a 50-pound sample of each type of off-site fill material that is to be used at the site. Submit samples a minimum of one week

July 11, 2018

POPE'S TAVERN
ADDITION/RENOVATION
Halifax, Massachusetts

prior to use of proposed material at the site. Submit samples to the testing laboratory and the Geotechnical Consultant (copy of these transmittal forms shall be sent to Engineer) or if no testing and/or Geotechnical Consultant is identified then the Engineer shall be the recipient of the samples. Use of these proposed materials by the Contractor prior to testing and approval shall be at the Contractor's risk.

- B. The Engineer will be responsible for the approval or rejection of the suitability of all materials.
- C. Submit the name of each material supplier and specific type and source of each material. Any change in source throughout the job requires approval of the Owner or Engineer.
- D. For use of fabrics or geogrids, submit manufacturer's literature for approval by the Engineer at least one (1) week prior to shipping materials to the site.
- E. In the event that temporary earth support is required, the Contractor shall submit the earth support design and drawings for the Geotechnical Engineer's review at least 2 weeks prior to commencing earth support construction. Design calculations shall be prepared by a Registered Professional Engineer in the Commonwealth of Massachusetts, experienced in the design of such systems and shall also include theoretical deflections of all excavation support members. At a minimum, the working drawings shall indicate the following:
 - 1. Grades and strengths of all construction materials used.
 - 2. Materials, details, arrangement, and method of construction of the proposed excavation support system and sequence of construction.
 - 3. Method(s) of installation, including a description of any staging that may be required to access the wall location.
 - 4. Loads on the excavation support system, including anticipated equipment and other surcharge loads on adjacent ground during construction.

1.7 COORDINATION

- A. Prior to start of earthwork the Contractor shall arrange an on-site meeting with the Engineer, the independent testing firm, and the Geotechnical Consultant for the purpose of establishing the Contractor's schedule of operations and scheduling observation and testing procedures and requirements.
- B. As construction proceeds, the Contractor shall be responsible for notifying the Engineer prior to the start of earthwork operations requiring observation and/or testing.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Subgrade is the material in excavation (cuts) and fills located below: subbase, base course layer for slabs, sidewalks, pavement, and other improvements.

- B. Common Fill/Ordinary Borrow shall be friable soil containing no stone greater than two-thirds (2/3) the loose lift thickness with a maximum stone size of twelve (12) inches in diameter. The material shall be essentially free of trash, ice snow, tree stumps, roots, organic materials, and other deleterious matter. Ordinary Fill shall not contain particles larger than 4 in. in maximum dimension and shall have a maximum of 80 percent passing the No. 40 sieve and a maximum of 30 percent passing the No. 200 sieve. It shall have a maximum dry density of at least 120 pounds per cubic foot and have physical properties such that it can be readily spread and compacted to the specified densities in a reasonable length of time. The material shall not contain materials subject to decay, decomposition, or dissolution.

- C. Gravel/Sand & Gravel shall consist of inert material that is hard, durable stone and coarse sand, free from loam, clay, surface coatings, trash, ice snow, tree stumps, roots, organic materials, and other deleterious matter, and shall conform to the following gradation:

July 11, 2018

POPE'S TAVERN
ADDITION/RENOVATION
Halifax, Massachusetts

Sieve (ASTM D422)	Percent Passing
3-inch	100
1/2-inch	50-85
No. 4	40-75
No. 10	30-60
No. 40	10-35
No. 100	5-20
No. 200	2-10

*Four inches (4") where placed as base below slab and pavement; One and one half inches (1 ½") where placed as pipe bedding and backfill up to 24 inches above pipe; and elsewhere two thirds (2/3) the loose lift thickness.

- D. Sand shall consist of clean, inert, hard, durable grains of quartz or other hard, durable rock, free from loam or clay, surface coatings, trash, ice snow, tree stumps, roots, organic materials, and other deleterious matter.

The allowable amount of material passing a No. 200 sieve as determined by AASHTO-T11 or ASTM D: 422 shall not exceed 10 percent by weight. The maximum particle size shall be 1/4-inch (i.e., 100 percent passing the No. 4 sieve).

In addition to the above criteria when sand is used for bedding concrete pavers and for utility bedding it shall conform to the following gradation.

Sieve (ASTM D422)	Percent Passing by Weight
No. 4	100
No. 8	80 – 95
No. 16	55 – 85
No. 50	0 – 35
No. 200	0 – 5

- E. On Site Disposal System Leaching Area, Sand Fill Material: **NOT USED**
- F. Crushed Stone shall be composed of durable crushed rock consisting of angular fragments, free from a detrimental quantity of thin, flat, elongated pieces or shall be durable crushed gravel stone obtained by artificial crushing of gravel boulders or fieldstone.

The crushed stone shall be free from clay, loam, trash, ice snow, tree stumps, roots, organic materials, and other deleterious matter.

Crushed Stone shall conform to the following gradations:

<u>Sieve Size</u>	<u>Percent Passing By Weight</u>	
	<u>1/2-Inch Stone</u>	<u>3/4-Inch Stone</u>
1 inch	---	100
3/4 inch	---	90-100
5/8 inch	100	---
1/2 inch	85-100	10-50
3/8 inch	15-45	0-20
No. 4	---	0-5
No. 8	0-5	---

<u>Sieve Size</u>	<u>Percent Passing By Weight</u>	
	<u>1-1/2-Inch Stone</u>	<u>2-Inch Stone</u>
2 inch	100	90-100
1-1/2 inch	95-100	---
1-1/4 inch	---	25-50
1 inch	35-70	---
3/4 inch	0-25	0-15
1/2 inch	---	---

- G. Dense-graded Crushed Stone for subbase and base
 Dense-graded Crushed Stone shall conform to the following gradation:

<u>Sieve Size</u>	<u>Percent Passing By Weight</u>
	<u>2-Inch Stone</u>
2 inch	100
1-1/2 inch	70-100
3/4 inch	50-85
No. 4	30-55
No. 50	8-24
No. 200	2-8

- H. Washed Crushed Stone for Stormwater Recharge shall be composed of durable crushed rock consisting of angular fragments, free from a detrimental quantity of thin, flat, elongated pieces or shall be durable crushed gravel stone obtained by artificial crushing of gravel boulders or fieldstone. The crushed stone shall be free from clay, loam, trash, ice snow, tree stumps, roots, organic materials, and other deleterious matter.

Washed Crushed Stone for Stormwater Recharge shall conform to the following gradation:

Percent Passing By Weight

<u>Sieve Size</u>	<u>2-Inch Stone</u>	<u>1-1/2 Inch Stone</u>
2 inch	90 – 100	100
1-1/2 inch	---	95 – 100
1-1/4 inch	25-50	45 – 80
1-inch	---	35 – 70
¾ -inch	0-15	0 – 25
½ -inch	0-5	0 – 5
No.4		0

- I. Double-Washed Crushed Stone for Wastewater Soil Absorption Systems: **NOT USED**
- J. Structural/Granular Fill shall be free from trash, ice snow, tree stumps, roots, sod, organic materials, and other deleterious matter or organic matter. Structural fill shall conform to the following gradation requirements:

<u>Sieve Size</u>	<u>Percent Passing By Weight</u>
*	100
No. 10	30-95
No. 40	10-70
No. 200	0-15**

* Two thirds (2/3) of the loose lift thickness. Fill placed in the upper three feet of the proposed building area should have a maximum size of 3 inches.

**0-8 for free-draining backfill behind walls

Some of the existing on-site fill (not containing organics or other deleterious materials, such as glass, cinders, metal, etc.) and natural granular soils may be used as Structural Fill if they are placed and compacted to the required densities contained herein. Samples of existing on-site fill to be reused must be tested prior to use as Structural Fill to evaluate gradation and the Proctor moisture density relationship.

Blast Rock Fill: **NOT USED**

- K. Choke Stone shall be hard, durable, clean, rock with a maximum rock diameter of 9 inches and shall conform to the following gradation requirements:

<u>Sieve Size</u>	<u>Percent Passing By Weight</u>
9 inches	100
6 inches	85-100
2 inches	70-85
¾ inches	45-60
No. 4	15-30
No. 40	5-30
No. 200	0-10

- L. Stone Fill shall be hard, durable, clean, washed rock with a minimum diameter of 1-1/2 inches and a maximum diameter of 3 inches with void ratio of 30 to 40 percent.

M. Revetment shall consist of slope protection of the required type at the location shown on the plans, and in conference with the lines and grades shown on the plans.

1. Riprap: **NOT USED**
2. Stone for Pipe Ends: **NOT USED**
3. Slope Paving: **NOT USED**
4. Channel Paving and Grouted Channel Paving: **NOT USED**
5. Filter Layer

The Filter Layer of stone shall be used under Riprap, Stone for Pipe Ends, Slope Paving, and Channel Paving (grouted or non-grouted). The Filter Layer shall be minimum of 6-inches in thickness, and shall meet the requirements of Crushed Stone as specified herein and/or shown on the Drawings.

6. Filter fabric

Filter fabric used with riprap, stone for pipe ends, slope paving, or channel paving (grouted or ungrouted) shall be as TenCate Mirafi® 600X or equivalent.

N. Filter Fabric/Geotextiles

1. Geotextile Fabric shall be used to prevent soil intrusion into drains, crushed stone layers and/or assist in stabilizing soil subgrades to be laid on approved soil subgrades prior to placement of fill materials.
 - i. Contractor shall use TenCate Mirafi® 140N or equivalent filter fabric in drainage recharge systems, underdrain systems between crushed stone and granular soils, leaching areas or where indicated on the plans.

O. Stormwater Detention Embankment Fill: **NOT USED**

P. Controlled Low Strength Material or Controlled Density Fill (CDF): Controlled low strength material or controlled density fill shall be a cement concrete backfill material that flows like a liquid, supports like a solid when cured, and levels without tamping or vibrating to reach 100 percent compaction. There are two main categories of CDF's, excavatable and non-excavatable with a sub category of flowable and very flowable. CDF shall be a mixture of Portland cement, fly ash (if very flowable), sand and water. The material shall be used primarily as a backfill in lieu of compacted fill in confined areas, or as otherwise shown on the Drawings or directed by the Engineer.

1. The material shall be proportioned to yield a 28 – day minimum compressive strength (f'_c) of 200 pounds per square inch (psi), except where placed around utility pipes and structures, where the f'_c shall be between 40 and 80 psi such that the cured material can be excavated.
2. The material shall be produced and installed in accordance with ACI 229R, and ACI 116R, with a mix formulation to be approved prior to placement of the material in the project.

3. The very flowable mixes shall contain a minimum of 250 pounds of class F Fly Ash or high air (25% plus) and will be self leveling.
4. Type C flyash or high lime flyash is not to be used, since it tends to increase the long term strength and may render the mix unexcavatable in the future.
5. Air-Entraining Admixture – the air content shall be in the 12-18% range.
6. No admixtures that tend to increase strength with time may be used without the written consent of the Engineer and an appropriate change of the mix where required.

Q. Topsoil/Loam

1. Topsoil (stripped from site) or Loam (supplied from off-site) shall be a sandy loam or loam soil classification as defined by the USDA Soil Conservation Service, Soil Classification System consisting of a fertile, friable, natural topsoil/loam typical of locality, without admixture of subsoil, refuse or other foreign materials, shall be obtained from a well-drained arable site, and shall meet ASTM D5268. It shall be such a mixture of sand, silt and clay particles as to exhibit sandy and clayey properties in about equal proportions. It shall be free of stumps, roots, heavy or stiff clay, stones larger than 3/4-inch in diameter, lumps, coarse sand, noxious weeds, sticks, brush or other litter, and shall have the following mechanical analysis:

<u>Textural Class</u>	<u>% of Total Weight</u>	<u>Average %</u>
Sand 0.05 - 2.0mm dia. Range	45 to 75	60
Silt 0.002 - 0.05mm dia. Range	15 to 35	25
Clay less than 0.002mm dia. Range	5 to 25	15

- i. 95 percent of Topsoil shall pass a 2.0mm sieve.
 - ii. Topsoil/Loam shall have a pH value range of 6.0 to 7.0. If Topsoil/Loam material does not fall within the required pH range, limestone or aluminum sulfate shall be added to bring the pH within the specified limit.
2. Prior to stripping, the topsoil shall demonstrate, by the occurrence upon it of healthy crops, grass or other vegetative growth, that it is reasonably well drained and that it does not contain toxic amounts of either acid or alkaline elements.
 3. Loam and topsoil shall contain not less than 4 percent nor more than 20 percent organic matter as determined by the loss on ignition of oven-dried samples. Test sample shall be oven-dried to a constant weight at a temperature of 230°F ±9°.
 4. In other portions of these specifications, the words "loam" and "topsoil" are used interchangeably.

R. Wetland Soils/Organic Materials: **NOT USED**

2.2 USE OF MATERIALS

Use of materials shall be as described below and as shown on the plans. Further details can be found in the project plans. Combinations or layering of materials may be necessary in certain instances such as for detention embankments, subsurface disposal areas, and riprap walls as examples.

- A. Common/Ordinary Fill: Use common/ordinary fill for general grading, as backfill, embankment fill in areas outside the building and pavement limits. Stones larger than twelve inches (12") shall be removed prior to compaction.
- B. Gravel/Sand and Gravel: Use for pipe bedding backfill and backfill below pavement and slab as base course layer. Use for material placed "in the wet". Use for backfill behind retaining walls and retaining structures. Use for pipe and utility bedding. Use for backfill within 3 feet behind retaining walls and retaining structures.
- C. Sand: Use for conduit bedding and initial backfill, and gas line bedding and backfill. Use for bedding and backfill of direct burial cables and/or flexible piping. Use for bedding and filling joints for concrete unit pavers.
- D. On-Site Disposal System Leaching Area Sand Fill Material: **NOT USED**
- E. Crushed Stone: Use crushed stone as a filter material around perforated pipe, as bedding for piping under wet subgrade conditions. Use crushed stone at the bottom of excavations to aid in construction dewatering and maintaining subgrade stability, backfill behind walls in confined areas, around perforated drain lines and as otherwise shown on the Drawings. Crushed Stone shall be wrapped in non-woven filter fabric when placed below buildings or when in excess of 6 inches thick below utilities and pavement. Use washed crushed stone in subsurface stormwater discharge area.
- F. Dense-Graded Crushed Stone: Use dense-graded crushed stone for sub-base and base material and as shown on the Drawings.
- G. Washed Crushed Stone: Use washed crushed stone in stormwater recharge system as the material around perforated pipe
- H. Double Washed 1-1/2 Inch Crushed Stone: Use double washed 1-1/2 inch crushed stone in soil absorption facilities for wastewater disposal systems, recharge filters and as a filter material around perforated pipe.
- I. Double Washed 1/2 Inch Crushed Stone: Use double washed 1/2 inch crushed stone in soil absorption facilities for wastewater disposal systems, recharge filters and as a filter material around perforated pipe.
- J. Structural/Granular Fill: Use structural/granular fill below subgrade elevation in building areas such as beneath floor slabs, foundations, and in other soil bearing situations. Structural/Granular fill shall also be used for backfill against building foundations and frost walls. Use structural/granular fills below pavement gravel base course.
- K. Choke Stone: Use where open voids and fractures are observed in blasted rock subgrade. An initial 12-inch thick minimum lift of Choke Stone shall be placed and compacted over the blasted rock surface prior to the placement of Structural Fill..

July 11, 2018

- L. Stone Fill: Use stone fill as additional storage medium for underground stormwater exfiltration trenches or pits.
- M. Filter Fabric/Geotextiles: To be used as filter barriers between drainage recharge systems, underdrain systems, wastewater absorption systems, and between natural earth material and backfill or other materials to assist in stabilizing soil subgrades.
- N. Detention Basin Embankment Fill: **NOT USED**
- O. Revetment:
 - Riprap: **NOT USED**
 - Stone for Pipe Ends: **NOT USED**
- P. Slope Paving: **NOT USED**
- Q. Channel Paving and Grouted Channel Paving: **NOT USED**
- R. Filter Layer: Use filter stone layer under riprap, stone for pipe ends, slope paving, channel paving and grouted channel paving or where indicated.
- S. Controlled Low Strength Material or Controlled Density Fill: Shall be used for trench backfill, anti-floatation bases, and/or lightweight backfill.
- T. Topsoil/Loam: Use as fill in designated landscape and lawn areas, if off-site material is required Loam shall be furnished and installed. Topsoil maybe used as fill in landscape and lawn areas, if an excess of topsoil exists on-site.
- U. Wetland Soil/Organic Materials: **NOT USED**

PART 3 - EXECUTION

3.1 EXCAVATIONS

A. General Definitions

1. Classification of Materials

- i. **Unclassified** – Unclassified excavation shall comprise and include the satisfactory removal and disposal of all materials encountered regardless of the nature of the materials, except for rock excavation and contaminated materials as defined below, and shall be understood to include, but not be limited to, earth, hardpan, fill, foundations, pavements, curbs, piping, railroad track and ties, cobblestones, footings, bricks, concrete, abandoned drainage and utility structures, and debris.
- ii. **Rock Excavations** – Rock is defined for payment purposes as stone or hard shale in original ledge, boulders over two cubic yards (2 yd³) in volume in open areas, and one cubic yard (1 yd³) in volume in trenches,

and masonry or concrete that cannot be broken or removed by normal job equipment (power shovels, scoops, or D-8 bulldozers with ripper attachment) without the use of explosives or drills. The classification does not include materials that can be removed by means other than drilling and blasting or drilling and wedging. Quantities shall be measured in their original position to the limits of clearly defined vertical construction lines and to the depth required for the defined construction. Payment will be at the unit prices stated in the contract.

2. Contaminated Materials

- i. The Contractor shall be familiar with the State Department of Environmental Protection (DEP) Hazardous Waste Regulations 310 CMR 30.00 and the Massachusetts Contingency Plan (MCP) 310 CMP 40.00 when conducting earthwork operations.
- ii. In general, a hazardous waste (contaminated with oil or hazardous materials) is a waste or combination of wastes which, because of its quantity, concentration, physical, chemical or infectious characteristics, may cause, or significantly contribute to, an increase in mortality or an increase in serious irreversible or incapacitating reversible illness or pose a substantial present or potential hazard to human health, safety, or welfare, or to the environment when improperly stored, treated, transported, or disposed of, or otherwise managed. (Additional criteria and characteristics to determine if a waste is hazardous are contained in 310 CMR 30.111, 30.112 and 30.120 through 30.125).
- iii. The Contractor shall immediately halt soil movement activities and notify the Owner if visual, olfactory or other evidence suggests that soils may be contaminated with oil or hazardous materials. Contractor shall provide reasonable assistance to Owner and to Owner's representative for access to potential contamination areas for proper assessment of hazardous conditions.
- iv. The Owner shall contact an environmental professional (such as a Licensed Site Professional) to test any earth materials suspected of containing hazardous waste. The results shall be evaluated by the environmental professional and compared with reporting thresholds found in the Massachusetts Contingency Plan (MCP) 310 CMR 40.0000. The Owner shall inform the Contractor of the laboratory test results as soon as possible and discuss the possible soil management, disposal, recycling options available. Contaminated soils shall be managed and handled in compliance with the referenced state/federal regulations, guidelines and policies. Time and expenses associated with contaminated soils shall be negotiated between the Contractor and the Owner prior to the start of the soil management, disposal, recycling work. Owner reserves the right to negotiate and contract with other entities for

remedial and, in that event, this Contractor shall make reasonable accommodations for other entities to perform this work.

- v. Although there is no evidence of oil or hazardous material, there is a possibility of the presence of such wastes on this site. Appropriate testing, as recommended by an environmental professional, shall be accomplished to assess the potential presence of oil or hazardous material. Earth material shall not be removed from the site unless on-site reuse is not possible.
- vi. Proper documentation of legal disposal of hazardous materials handled by this Contractor shall be provided by the Contractor to the Owner, Engineer, and review authorities. Additional guidance for possible disposal activities can be found in the Department of Environmental Protection's Policy #COMM-97-001, Reuse and Disposal of Contaminated Soil at Massachusetts Landfills.
- vii. Unless specifically identified as contaminated material under referenced statutes and as defined above, as judged by the engineer, excavated materials shall be considered unclassified as defined in item 1. above.

B. Site General Requirements

1. It is the Owner's intent that soil excavated at the Site is reused on Site to the extent practical and off-site disposal will only be allowed upon written authorization of the Owner. Classification of excess material (if any) will be the responsibility of the Environmental Consultant engaged by the Owner.
2. No soil shall be removed from the site unless required by State environmental regulations or where soil is deemed unsuitable for reuse by the Geotechnical Engineer, or as approved by the Owner. Materials that must be removed from the site because they are unsuitable due to high moisture, and requiring material to be imported, shall be removed from the site at no cost to the Owner.
3. Excavation shall include the removal of all materials and include earth, fill, boulders, concrete, bricks, abandoned foundations and drainage/utility structures, debris, and other man-made materials.
4. Control the grading so that ground is pitched to prevent water from running to excavated areas, damaging other structures, or adjacent properties.
5. Where soil has been softened or eroded by flooding, equipment, traffic, or placement during unfavorable weather, or such other conditions, it shall be removed and replaced by the Contractor with suitable material, and at no additional cost to the Owner, and under the continuous observation of the Engineer. The Contractor shall make every effort to protect excavated soil from inclement weather, including but not limited to protection with plastic sheeting.

6. Exercise care to preserve the material below and beyond the lines of excavation. Where excavation is carried out below indicated grade or beyond the lines of excavation, Contractor shall backfill and compact the over excavation with Structural Fill to the indicated grade, at no additional cost to the Owner and at the direction of the Engineer.
7. Provide sheeting, shoring and bracing to complete and protect all excavated areas, as required for safety and compliance with OSHA regulations (29 CFR 1926, Subpart P). Alternatively, lay back excavations to stable slope, in accordance with OSHA regulations. Costs for sheeting, shoring, and bracing shall be included as a part of the contract price for completing the work and Owner shall make no separate payment for this work.
8. Excavated materials unsuitable for reuse, surplus excavated rock and surplus excavated soil not used to fulfill requirements of the Contract, shall become the property of the Contractor and shall be removed from the site in accordance with the regulations and requirements of all municipalities or agencies having jurisdiction over the disposal sites and the route between the project and the disposal sites.
9. Limits of excavation are such that all unsuitable material will be removed to firm natural ground or bedrock in the manner specified below. In building areas, unsuitable materials shall be removed to a distance of ten feet (10') beyond the building lines or within the area defined by a one horizontal to one vertical (1h:1v) line sloping down from outside bottom edge of exterior footings to firm natural ground or bedrock, whichever is greater. Limits of unsuitable material excavation also apply to areas below exterior column footings.
10. Abandoned pipes within proposed building areas and former foundations at the site are to be removed and the excavations are to be properly backfilled. Abandoned utilities within proposed parking areas and more than 4 feet below proposed grade shall either be removed or the ends cut and filled with grout.
11. The Contractor shall segregate excavated material into stockpiles depending on the type and reuse potential of the material. At a minimum, the following materials shall be segregated separately:
 - i. Fill soils not containing debris, ash or organics;
 - ii. Fill soils containing debris, ash or organics;
 - iii. Natural granular soils; and
 - iv. Organic soils.
 - v. Soils exhibiting potential chemical contamination based on visual or olfactory evidence
12. Excavated material shall be reused on the site, provided it meets the gradation requirements for the given materials in the information of fill sections, embankments, subgrades, backfills, etc. and can be compacted as required herein.

13. The existing asphalt and underlying base course may be reclaimed and reused as pavement base course or subbase fill on site in parking areas provided they are processed to meet the gradation requirement of the fill or backfill material they are intended to be used as. Reclaimed asphalt may not be reused within proposed building footprints.
14. Unsuitable materials are defined as existing fill and organics such as (but not limited to) surficial and buried topsoil and subsoil, peat, trash, stumps, debris. Unsuitables also includes other deleterious and hazardous material determined by Engineer to be unacceptable for incorporation into the work.
15. Under pavement areas, existing fill will be densified in place and will not be excavated provided it is firm and stable under densification. Topsoil and subsoil need not be excavated from pavement areas if located more than three feet (3') below finish pavement grades. Trees and stumps shall be removed from proposed pavement areas. Abandoned pipes, that are buried more than four feet (4') from finish grade to the top of the pipe and that do not interfere with utilities to remain or to be installed, shall be capped and/or grouted at both ends and left in place. Abandoned pipes less than four feet from finish grade shall be removed and the trench appropriately backfilled with structural fill.
16. All suitable material, as determined by the Engineer, may be reused on the site, provided it meets the gradation requirements for the given materials in the information of fill sections, embankments, subgrades, backfills, etc.
17. Do not over excavate below proposed design grades for the purpose of obtaining borrow for use off-site.

C. Proof-rolling

1. Prior to placing of the initial layer of compacted fills, the Contractor shall proof roll the natural grades, above groundwater table elevation, to remain. Where materials of low density are indicated by rutting or weaving under the compactor, the Contractor may be required to make up to three (3) additional complete coverages of the area with a vibratory drum roller, having a minimum static weight of 10,000 pounds, as determined by the Engineer. The cost of all proof rolling shall be included in the Contract Sum. If materials of low density are encountered that cannot be compacted to the extent necessary to support the proposed embankment fills as determined by the Engineer, the Contractor shall remove those materials and replace them with compacted fill. The cost of excavation and replacement of such unsuitable material shall be paid for at the price set in the Proposal. Extra payment will be made for material removed below normal grade only when ordered in writing to be removed.
2. Alternately, an initial layer of fill may be allowed to form a working platform. The need, manner of construction, and thickness of such a layer shall be subject to approval of the Engineer and the layer will be permitted only where the lack of support is, as determined by the Engineer, not due to deficient ditching, grading or drainage practices, or where the embankment could be constructed in the approved manner by the use of different equipment or procedures. Thickness of up to eighteen (18) inches may be permitted for such a layer.

3. Any weak or soft spots identified by the Geotechnical Engineer during proofrolling shall be overexcavated and replaced with Structural Fill or Sand-Gravel Fill, placed and compacted in accordance with these specifications.
4. When near or below the water table, proofrolling should be at the discretion of the Engineer and may be performed using static (non-vibratory) equipment.

D. Potentially Contaminated Materials

1. The Contractor shall be familiar with the Massachusetts Department of Environmental Protection (MassDEP) Hazardous Waste Regulations 310 CMR 30.00 and the Massachusetts Contingency Plan (MCP) 310 CMR 40.00 when conducting earthwork operations.
2. The Contractor shall immediately halt soil movement activities and notify the Owner if visual, olfactory, or other evidence suggests that soils may be contaminated with oil or hazardous materials. Contractor shall provide reasonable assistance to Owner and to Owner's Environmental Consultant for access to potential contamination areas for proper assessment of hazardous conditions.
3. The Owner shall engage an Environmental Consultant to test any earth materials suspected of containing chemical contaminants. The results shall be evaluated by the Environmental Consultant and compared with reporting thresholds found in the Massachusetts Contingency Plan (MCP) 310 CMR 40.0000. The Owner shall inform the Contractor of the laboratory test results and discuss the possible soil management, disposal, and recycling options available. Contaminated soils shall be managed and handled in compliance with the referenced state/federal regulations, guidelines, and policies. Time and expenses associated with contaminated soils shall be negotiated between the Contractor and the Owner prior to the start of the soil management, soil disposal, and recycling work. Owner reserves the right to negotiate and contract with other entities for remedial work and, in that event, this Contractor shall make reasonable accommodations for other entities to perform this work.
4. Proper documentation of legal disposal of contaminated materials handled by this Contractor shall be provided by the Contractor to the Owner, Engineer, and review authorities. Additional guidance for possible disposal activities can be found in the Department of Environmental Protection's Policy #COMM-97-001, Reuse and Disposal of Contaminated Soil at Massachusetts Landfills.
5. Unless specifically identified as contaminated material under referenced statutes and as defined above, as judged by the Engineer, excavated materials shall be considered unclassified and no payment will be made for off-site disposal of unclassified materials.

3.2 TRENCH EXCAVATION

- A. Excavate as necessary for all drainage pipes, utilities and related structures and appurtenances, and for any other trenching necessary to complete the work.
- B. Definitions

1. Trench shall be defined as an excavation of any length where the width is less than twice the depth and where the shortest distance between payment lines does not exceed ten (10') feet. All other excavations shall be defined as open excavations.
 2. The words "invert" or "invert elevation" as used herein shall be defined as the elevation at the inside bottom surface of the pipe or channel.
 3. The words "bottom of the pipe" as used herein shall be defined as the base of the pipe at its outer surface.
- C. In general, machine excavation of trenches will be permitted with the exception of preparation of pipe beds which will be hand work. Excavate by hand or machine methods to at least six (6") inches below the bottom of pipe or as shown on the Drawings. Excavation to final grade shall be made in such a manner as to maintain the undisturbed bearing character of the soils exposed at the excavation level.
- D. Utilities or piping shall not be laid directly on boulders, cobbles or other hard material. This material shall be removed to a minimum of six inches (6") below the bottom of pipe at all points and backfilled or compacted as specified.
- E. Remove unsuitable material (e.g. debris, organic soils) encountered at subgrade elevations, backfill with material specified herein and as otherwise indicated on the Drawings, specified or directed. Compact as specified with approved compactors.
- F. In general, the width of trenches shall be kept to a minimum and in the case of piping shall not exceed the sum of the pipe's outside diameter plus 2'0" to at least twelve (12") inches above the pipe. However, in all cases, trench excavation shall meet the requirements of OSHA regulations.

3.3 SUBGRADE PREPARATIONS

- A. All subsurface utility construction shall be completed before fine grading is begun.
- B. The pavement and curb subgrade shall be fine graded to the location, elevations and cross slope shown on the Contract Drawings.
1. Within new pavement areas, remove existing fill to the minimum depth required to accommodate Finish, Binder and Sand-Gravel Base courses. Existing fill below pavement base course may be left in place provided the subgrade is proof-compacted with a minimum of six passes of a vibratory drum roller (with a minimum static drum weight of 10,000-pounds capable of at least 20,000 pounds of dynamic force).
 2. In areas where a raise in grade greater than 2 feet is proposed, place fill to proposed pavement subgrade elevation and leave the fill in place at this elevation (or higher) for at least 4 weeks prior to paving.
 3. Proofrolling of subgrades must be observed and accepted by the Engineer prior to placement of backfill.
 4. Where organic soils are present at or below bottom of infiltration areas and retaining walls, remove organic soils from below infiltration area to natural granular soils. In

other pavement areas, existing buried organics may be left in place provided they are at least 3 feet below proposed finish grades.

- C. Subgrades in in-situ soils in excavation areas and in embankment areas shall be compacted during fine grading to 90 percent of maximum dry density in conformance with Section 312300 – Excavation and Backfill.

3.4 SUBBASE MATERIAL PLACEMENT

- A. Subbase material shall not be placed until the Engineer has approved the fine grading, compaction and condition of the subgrade.
- B. Subbase material shall be placed and spread on the approved subgrade in layers not exceeding eight inches in thickness by approved self spreading equipment. Any displacement of the compacted subgrade material by the equipment shall be restored to the required grade and recompacted before placement of the subbase material.
- C. Subbase material shall be compacted to 95 percent of maximum dry density in conformance with Section 312300 – Excavation and Backfill.
- D. The surface of the subbase material shall be fine graded to the location, elevations and cross slope shown on the Drawings during final layer compaction operations.

3.5 BASE MATERIAL PLACEMENT

- A. Base material shall not be placed until the Engineer has approved the fine grading, compaction and condition of the subbase material.
- B. Base material shall be spread on the approved subbase in layers not exceeding four inches in thickness by approved self spreading equipment. Any displacement of the subbase material by equipment shall be restored to the required grade and recompacted before placement of the base material.
- C. Base material shall be compacted to 95 percent of dry density in conformance with Section 312300 – Excavation and Backfill.
- D. The surface of the base material shall be fine graded to the proposed location, elevations and cross slope shown on the Drawings during final layer compaction operations.

3.6 ROCK EXCAVATIONS

A. Definitions

1. Rock is defined for payment purposes as stone or hard shale in original ledge, boulders over two cubic yards (2 yd³) in volume in open areas, and one cubic yard (1 yd³) in volume in trenches, and masonry or concrete that cannot be broken or removed by normal job equipment (power shovels, scoops, or D-8 bulldozers with ripper attachment) without the use of explosives or drills.
2. The definition does not include materials that can be removed by means other than drilling and blasting or drilling and wedging.

B. General

1. When rock is encountered, such material shall be removed to the clearance limits set forth in these specifications.
2. Payment for rock excavation shall be made in accordance with Item 3.02 A.1.
3. Rock Excavation shall be performed to eliminate water pockets in the excavated rock subgrade. Contractor shall provide dewatering as required to keep the excavated rock subgrade dry until earthwork operations are complete.

C. Blasting

1. Contractor shall, before doing any blasting work, present to the Owner's Representative written certificate of insurance showing evidence that his insurance includes coverage for blasting operations.
2. No blasting shall be done without giving 24 hour prior notice to the Engineer. Written permission and approval of methods must be obtained from appropriate governing authorities.
3. The Driller and Geotechnical Engineer shall log the bottom elevation of all drill holes made for blasting within the building area.
4. Experienced powdermen or persons who are licensed or otherwise authorized to use explosives shall do blasting. Accurate records shall be maintained, noting location of each blast, time of detonation, total explosive weight in each blast, maximum explosive weight per delay in each blast hole, and designation of delay cap used in each hole.
5. Explosives shall be stored, handled, and employed in accordance with state and local regulations, or, in the absence of such, in accordance with the provisions of the Manual of Accident Prevention in Construction of the Associated General Contractors of America, Inc. and in accordance with applicable OSHA regulations.
6. The amount of vibration and airblast overpressure generated by blasting shall not exceed regulatory statutes or directives established by state, local or other governing authorities. In no case shall the maximum Peak Particle Velocity (PPV) exceed the limits indicated on figure B-1, Appendix B, of the United State Bureau of Mines Report of Investigations, RI8507, 1980. These limits shall apply at all existing and under construction structures, and utilities, as well as at property and construction limits.
7. Contractor shall take great care to do no damage to existing buildings, foundations, glass and glazing, and trees to remain. Damage caused by Contractor's blasting operations shall be repaired by Contractor at no additional cost to the Owner

D. Cross Sectioning and Measurement

1. When rock is encountered, it shall be uncovered and exposed, and the Engineer shall be notified in writing by the Contractor before blasting work proceeds. Quantities shall be based on measurements in their original position and to the limits of clearly defined vertical and horizontal construction lines required for the defined construction.

July 11, 2018

POPE'S TAVERN
ADDITION/RENOVATION
Halifax, Massachusetts

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2. The rock shall then be measured, quantities established, and payment amounts shall be determined.
 3. Excavation of material in question before agreement by the Engineer as to the character of the material, or failure to notify the Engineer, or failure to take measurements will forfeit the Contractor's right to payment for rock excavation.
 4. The quantity of rock to be removed shall be based on the limits established under the Clearance Limits below.
 5. Measurements shall be made by a Registered Surveyor, paid for by the Contractor and approved by the Engineer.
 6. Cross section and measuring shall not be required when the payment for rock excavation is included as a part of the lump sum contract price as defined in item 3.02 A.1.

E. Clearance Limits

1. Foundations and Slabs: Within the limits of the concrete lines as defined by the working plans or by duly authorized modifications thereto, plus twelve inches (12") outside the vertical concrete lines and eighteen inches (18") below base.
2. Utility Trenches: All parts of pipe, valves and fittings to a depth of six inches (6") below the bottom of the bell and for a width equal to the outside diameter of the pipe, plus fifteen inches (15") beyond the outside diameter on each side, provided that overlapping computed volumes of any ledge or boulder excavation shall be paid for only once.
3. Paved Areas: To eighteen inches (18") below finished pavement grade.
4. Site Structures: Twelve inches (12") outside of structure all around.
5. Lawn areas and shrub planting areas: To a depth of eighteen (18) inches below finished grade.
6. Planting areas for trees over two inches in caliber size: To depth of thirty-six (36) inches below finished grade and for a radius of 3 feet around each tree, except volumes in radius areas shall not overlap.
7. Any foreseen rock or boulder encountered, as defined above, which must be removed for construction of the work defined on the plans or in modification thereto, shall be measured in its original position to the limits of clearly defined vertical construction lines and to the depth required for the defined construction.

F. Reuse of Excavated Rock

1. Riprap

Excavated rock may be used as riprap, for construction of stone masonry walls and for sloped riprap for retaining walls, provided rock is judged to be adequate quality by the

July 11, 2018

Owner's representative and it is sufficiently broken to meet gradation requirements established for the intended use.

2. Fills

Reuse of excavated rock for fill materials shall require prior approval of the Owner's representative and shall require compliance with gradation requirements for the specific type of fill for which it is being used.

G. Rock Subgrades under Building Footings and Paved Areas

1. Excavation of rock under footings and paved areas shall include the removal of all loose material to the top of sound bedrock that is acceptable to the Owner's Representative. Sound bedrock is defined as hard, intact rock that cannot be excavated with a track mounted excavator, such as a Caterpillar 320L.
2. Rock surface below footings shall have a maximum slope of 4 horizontal to 1 vertical.

3.7 PREPARATION OF EXCAVATION BOTTOMS

A. General Rock Subgrade Areas

1. Rock surfaces to receive backfill shall have a maximum slope of four (4) horizontal to one (1) vertical.
2. Rock excavations carried below design grade and clearances shall be backfilled with lean concrete with a minimum compressive strength of 1500 psi.

B. Building and Pavement Areas

1. Loose rock is covered with 12 inches of crushed stone or choke stone; and
2. Prior to placing crushed or choked stone, the area is rolled with at least four passes of a heavy vibratory roller, RayGo 600 or equal.
3. Proofroll subgrade with a vibratory roller or by minimum of two passes of a fully loaded ten-wheeled dump truck. Soft or hard areas and other objectionable material (stumps, wood, organics) shall be excavated and backfilled with compacted structural fill.
4. Prior to the placement of fill over a bedrock subgrade, voids in the rock surface shall be choked off with appropriately graded crushed stone or Choke Stone to prevent migration of fines into fractures, as directed by the Owner's Representative.

C. Subgrades under proposed landscape areas

1. Depth to rock under planting areas shall be a minimum of 48 inches below subgrade elevations. Backfill to subgrade shall be with topsoil/loam materials.
2. In lawn areas, scarify subsoil a minimum depth of six inches. Subsoil shall also be cleared of debris and stones larger than four inches prior to topsoil spreading.

3. In planting areas, scarify subsoil a minimum depth of six inches below the required root ball excavation prior to placement of plant backfill mixture.

D. Trenches

1. Compaction equipment used in open areas where space permits shall consist of vibratory rollers weighing at least 15,000 pounds, fully loaded ten-wheel dump trucks, pneumatic compactors or other similar equipment.
2. Compaction equipment for fill against foundation walls and in other confined areas shall be accomplished by means of drum-type, power-driven, hand-guided vibratory compactors operating at 2,000 cycles per minute, or by hand-guided vibratory plate tampers.

3.8 BACKFILLING AND PLACEMENT OF FILL MATERIALS

A. Site

1. Dewater subgrade areas prior to filling.
2. Compaction by puddling or jetting is prohibited.
3. Control groundwater and surface runoff to minimize disturbance of exposed natural ground surface, previously placed and compacted fill and material being placed.
4. Soil fill moisture shall be maintained at an acceptable working range to allow for proper compaction.
5. Do not place fill on frozen ground.
6. Do not place frozen fill.
7. Place fill in uniform horizontal layers and compact immediately after placement. Where the horizontal layer meets a rising slope, the layer shall be keyed into the slope by cutting a bench during spreading of preceding lift.
8. To the extent that is practical, each layer of fill shall be compacted to the specific density the same day it is placed.
9. Slope fill surfaces at the end of each day to provide for free surface drainage.
10. Protect structures and pipes from damage during backfilling operations. Repair damage at no cost to owner.
11. Placement of fill shall not begin prior to observation and approval of subgrade conditions by Engineer.
12. Protect foundations, footings, and waterproofing during backfilling. Repair damage at no cost to Owner.

13. Prior to backfilling between foundation wall and sheeting, remove unsuitable material, including rubbish, organic materials or other debris. Do not commence filling operations until conditions have been observed by Engineer.
14. Backfill shall not be placed against walls until they are braced or have cured sufficiently to develop strength necessary to withstand, without damage, pressure from backfilling and compacting operations.
15. Provide shoring, sheeting, and bracing of excavations as required to assure complete safety against collapse of the earth at the site of excavations. Alternatively, lay back excavations to suitable slope.
16. Upon completion of the work, the final ground surface shall be left in a firm, unyielding, true, uniform condition free from ruts. Repair disturbed areas caused equipment traffic at no cost to Owners.

B. Equipment

1. Compaction equipment used in open areas where space permits shall consist of vibratory rollers weighting at least 15,000 pounds, fully loaded ten-wheel dump trucks, pneumatic compactors of other similar equipment.
2. Compaction equipment for fill against foundation walls and in other confined areas shall be accomplished by means of drum-type, power-driven, hand-guided vibratory compactors operating at 2,000 cycles per minute, or by hand-guided vibratory plate tampers.

C. Placing Fill

1. Fill sections and embankments shall be constructed of earth, rock or a mixture of earth and rock deposited in successive lifts. Except as hereinafter permitted, the loose thickness of each lift shall not be more than twelve (12) inches before compaction.
2. No rock in excess of six (6) inches in its largest dimension shall be incorporated in the top two (2) foot layer of embankment immediately below the subgrade.
3. During fill and embankment construction operations, earth moving equipment shall be routed as evenly as possible over the entire width of the work.
4. At the close of each day's work the working surface shall be crowned, shaped, and rolled with smooth steel or pneumatic tired rollers to ensure proper drainage.
5. Prior to placing compacted Structural Fill below the slab, the surface of natural ground, shall be proof-rolled with at least four passes of a heavy vibratory drum roller, such as a RayGo 600 or equal. Hard and soft spots shall be excavated and replaced with Structural Fill or other material acceptable to the Owner's Representative.
6. Where excavations for slab-on-grade extend to weathered fractured, or blasted bedrock, the Owner's Representative shall assess the rock surface for the presence of voids and may require placement of a 6 to 18 inch layer of choke stone or crushed stone prior to placement of structural fill.

D. Fills under Parking Areas

1. Paved area subgrades shall be excavated to a minimum of 12 inches beneath required subgrade elevation or existing grade, whichever is lower.
2. Proofroll subgrade with a vibratory roller or by minimum of two passes of a fully loaded ten-wheeled dump truck. Soft or hard areas and other objectionable material (stumps, wood, organics) shall be excavated and backfilled with compacted structural fill.
3. Where excavations for pavements extend to weathered, fractured, or blasted bedrock, prepare surface as indicated in Section 3.07(B) for building and pavement areas.
4. A minimum of 12 inches of gravel base course shall be provided between subgrade and the bottom of the bituminous surface.

E. Subgrades Under Proposed Landscape Areas

1. Fills under tree and shrub planting areas shall be back filled with topsoil/loam materials.

F. Buildings

1. Prior to the placement of fill over a bedrock subgrade, voids in the rock surface shall be choked off with appropriately graded crushed stone or Choke Stone to prevent migration of fines into fractures, as directed by the Owner's Representative.

Choke Stone fill and crushed stone shall be placed and compacted as indicated below.

2. Choke Stone and Crushed Stone Placement and Compaction:

- i. Maximum lift thickness prior to compaction is 12 in.

3. Structural Fill: A minimum of 24 inches of compacted structural fill shall be placed in maximum 12-inch lifts immediately below the slabs.

G. Revetments

1. General

- i. Areas to be protected by revetment shall be free of brush, trees, stumps and other organic material and be dressed to a smooth surface. All soft or spongy material shall be removed to the depth shown on the plans or as directed by the Engineer and replaced with approved materials.
 - ii. A toe trench shall be dug and maintained until the revetment is placed.
 - iii. Protection for structure foundations shall be provided as early as the foundation construction permits.
 - iv. The area to be protected shall be cleaned of waste materials and the surface to be protected prepared as shown on the plans.

- v. Where shown on the plans, a foundation filter bed shall be placed on the area before the stone is placed. The foundation filter bed will be six inches of dense graded crushed stone and six inches of one half inch crushed stone and at least 12 inches in total thickness.

2. Riprap

- i. The stones shall be placed upon an approved filter bed to the lines and grades shown on the plans and as directed.
- ii. Each stone shall be carefully placed, by hand or machine as required, on a prepared bed, normal to the slope and firmly bedded thereon.
- iii. The larger stone shall be placed closely together and the intervening spaces filled with smaller stones in such a manner that the entire surface will form a compact mass.

3. Stone for Pipe Ends

- i. Stone for pipe ends shall consist of a protective covering of angular shaped stones laid on slopes in front of and around drainage line ends or structures to insure protection of the pipe ends and the embankment and shall conform to the requirements for "Stone for Pipe Ends".
- ii. The stone shall be placed to line and grade as shown on the plans or as directed on a prepared bed of embankment material or existing materials. Each stone shall be carefully placed by hand, normal to the slope and firmly bedded thereon. The larger stones shall be placed directly at the drainage end to prevent erosion and displacement. Each stone shall weigh not less than the minimum specified nor more than the maximum specified and at least 75 percent of the volume shall consist of stones weighing not less than the d_{50} Median. The remainder of the stones shall be so graded that when placed with the larger stones, the entire mass will be compact with a minimum amount of voids and a minimum thickness of 9 inches.

4. Slope Paving

- i. The stones shall be placed upon an approved filter bed to the lines and grades shown on the plans and as directed. The larger stones shall be placed closely together throughout the surface and the interstices carefully chinked with smaller stones. All stones shall be securely bedded, with the exposed surfaces approximately parallel to and within 6 inches of the slope shown on the plans. When the paving cannot be laid to the required line and grade below water, a suitable foundation of dumped riprap shall be constructed.

5. Channel Paving and Grouted Channel Paving

- i. All stones shall be placed upon an approved bed to the lines and grades shown on the plans and as directed. The larger stones shall be placed as closely together as possible throughout the surface. All stones shall be securely bedded and laid so that the exposed surfaces will be approximately parallel to and within 3 inches tolerance of the grade shown on the plans. The finished paving shall present a continuous uniform surface of stonework.
- ii. Grouting, when required, shall be done after the paving is completely in place. The paving stones shall be sprinkled with water immediately before placing the grout.

3.9 TRENCH BACKFILLING

A. General

1. Trenches shall be backfilled as soon as practicable with suitable approved materials. All trench backfilling shall be done with special care, in the following manner and as the Engineer may direct from time to time.
2. Backfill material for pipe bedding shall be deposited in the trench, uniformly on both sides of the pipe, for the entire width of the trench to the springline of the pipe. The backfill material shall be placed by hand shovels, in layers not more than 6 inches thick in loose depth, and each layer shall be thoroughly and evenly compacted by tamping on each side of the pipe to provide uniform support around the pipe.
3. Trench backfilling shall be placed so as not to disturb the previously installed pipes, utilities, concrete, and other work within and near the trench. The moisture content of the backfill material shall be such that proper compaction will be obtained. Backfill of trenches within areas of pavement construction shall be made in controlled compacted lifts extending to grades required to establish the proper pavement base courses.
4. In backfilling trenches, each layer of backfill material shall be adequately compacted in such a manner as to provide the required bearing value, so that paving can proceed immediately after backfilling is completed.
5. Any trenches or excavations improperly backfilled, or where settlement occurs, shall be reopened to the depth required for proper compaction, then refilled and compacted with the surface restored to the required grade and condition, at no additional expense to the Owner.
6. During filling and backfilling operations, pipelines will be checked to determine whether any displacement of the pipe has occurred. If the inspection of the pipelines shows poor alignment, displacement of pipe, or any other defects, the condition shall be remedied by removal, realignment, and backfill of the pipe, in a manner satisfactory to the Engineer at no additional cost to the Owner.

B. Embedment

The type of materials to be used in bedding and backfilling shall conform to the details shown on the Drawings and the following:

1. Embedment materials are those used for bedding, haunching and initial backfill. Perform in accordance with ASTM D2321. The following will describe the soils:
 - i. Class I – Angular crushed stone or rock, dense or open graded with little or no fines (3/4 inch stone size) (to be used in wet conditions or where shown on the Drawings)
 - ii. Class II – Clean, coarse grained gravel, with a maximum stone size of the 1-1/2 inches
 - iii. Embedment materials shall be free from lumps of frozen soil or ice when placed. Embedment materials shall be placed and compacted at optimum moisture content.
2. Foundation: A stable utility foundation of Class I or II material must be provided to insure proper line and grade is maintained. Unsuitable foundations such as organics, soft clay, and other soft materials must be removed and the material stabilized. Unsuitable or unstable foundation materials shall be undercut and replaced with a suitable bedding material of Class I or Class II (see 3.08 B5), placed in 6" lifts. The Engineer may approve other methods of stabilization, such as geotextiles.
3. Bedding: Provide a stable and uniform bedding for the pipe and any protruding features of its joints and/or fittings. The bedding for the middle 1/3 of the pipe outside diameter should be loosely placed so that the pipe conforms to the trench. The remainder of the bedding at the base of the trench shall be compacted to a minimum of 95 percent modified proctor density as determined by ASTM Test method D1557. Class I, or II materials are suitable for use as bedding.
4. Haunching: Proper haunching provides a major portion of the pipe's strength and stability. Care must be exercised to insure placement and compaction of the embedment material in the haunches. For larger diameter pipes (> 30"), embedment materials should be worked under the haunches by hand. Haunching materials may be Class I, or II and must be placed and compacted in 6-inch maximum lifts, compacted to 95 percent modified proctor density.
5. Initial Backfill: Initial backfill materials are required for a minimum of 3/4 of the pipe diameter. The initial backfill shall be from the springline to 24 inches above the pipe to provide protection for the pipe from construction operations during placement of the final backfill and protect the pipe from stones or cobbles in the final backfill.
 - i. Class I materials must be used in wet trenches and Class I bedding and haunching materials shall be used.
 - ii. Class II materials shall be used unless noted otherwise or wet conditions are encountered. The material shall be compacted in 6 inch lifts to 95 percent modified proctor density (ASTM D1557).
 - iii. Flooding or jetting as a procedure for compaction are not allowed.

6. Controlled Low Strength Materials (CLSM) or Controlled Density Fill (flowable fills) are acceptable backfill materials. Several considerations should be accounted for when using CLSM/CDF backfill. Provisions to prevent floatation of the pipe during placement of the CLSM/CDF must be used. This can include anchoring the pipe by placing flowable fill at the each joint and allowing the fill to partially cure prior to placing the flowable fill along the entire length of the pipe. Also, mechanical anchors such as bent rebar driven into competent soil or precast weights, may be used at each joint to prevent floatation. When using CLSM/CDF, the fill should always be placed to completely encase the pipe.
7. Backfill. Backfill from one foot (two feet for HDPE pipe) above the top of the pipe to subgrade elevations shall be structural fill material. Generally, the excavated trench material may be used as this backfill. This backfill shall be placed in 12-inch maximum lifts and compacted to a minimum of 92 percent modified proctor density to prevent excessive settlement at the surface.
8. Vehicular and Construction Loads: Pipe installation shall be suitable to carry H-25 live loads (40,000 lbs. Axle - legal load) with 24 inches of cover.

3.10 BACKFILLING AGAINST STRUCTURES

- A. Backfilling against masonry or concrete shall only be done when approved. The Contractor shall not place backfill against or on structures until they have attained sufficient strength to support the loads (including construction loads) to which they will be subjected, without distortion, cracking or other damage. As soon as practicable after the structures are structurally adequate and other necessary work has been satisfactorily completed, any leakage tests or other testing of the structures shall be made by the Contractor, as required by the Engineer, at the Contractor's expense.

After the satisfactory completion of leakage tests and the satisfactory completion of any other required work in connection with the structures, the backfilling around the structures shall proceed using suitable and approved excavation material. The best of the backfill material shall be used for backfilling within 2 feet of the structure. Just prior to placing backfill, the areas shall be cleaned of all excess construction material and debris and the bottom of excavations shall be in a thoroughly compacted condition.

- B. Symmetrical backfill loading shall be maintained. Special care shall be taken to prevent any wedging action or eccentric loading upon or against the structures.

During backfilling operations, care shall be exercised that the equipment used will not overload the structures in passing over and compacting these fills. Except as otherwise specified or directed, backfill shall be placed in layers not more than 12 inches in loose depth and each layer of backfill shall be compacted thoroughly and evenly using approved types of mechanical equipment. Each pass of the equipment shall cover the entire area of each layer of backfill.

- C. In compacting and other operations, the Contractor shall conduct his operations in a manner to prevent damage to structures due to passage of heavy equipment over and adjacent to structures. Repair damage made by the Contractor, at no additional expense to the Owner.
- D. After backfilling the Contractor shall maintain the surfaces of backfill areas in good condition so as to present a smooth surface at all times level with adjacent surfaces. The Contractor

shall repair any subsequent settling over backfilled areas immediately, in a manner satisfactory to the Engineer, and such maintenance shall be provided by the Contractor for the life of this Contract, at no additional expense to the Owner.

- E. The finished subgrade of the filled excavations upon which pavements are to be constructed shall not be disturbed by traffic of other operations and shall be maintained in a satisfactory condition until the finished courses are placed. The storage or stockpiling of materials on finished subgrade will not be permitted.
- F. Uniformly smooth grading of all areas to be graded, as indicated including excavated sections and all areas disturbed as a result of the Contractor's operations, shall be accomplished. The finished surfaces shall be reasonably smooth, compacted and free from surface irregularities.

3.11 COMPACTION

A. Compaction Requirements

- 1. The degree of compaction is expressed as a percentage of the maximum dry density at optimum moisture content as determined by ASTM Test D1557, Method C. The compaction requirements are as follows:

<u>Area</u>	<u>Minimum Degree of Compaction</u>
Below footings	95%
Below slabs	95%
Detention basin berms	95%
Pavement base course	95%
Pavement subbase	95%
General fill below pavement subbase	95%
Trench backfill	92%
Lawn areas	90%

- 2. Compaction percentages are based on the laboratory derived Maximum Density Values.

B. Moisture Control

- 1. Fill that is too wet for proper compaction shall be harrowed, or otherwise dried to a proper moisture content to allow compaction to the required density. If fill cannot be dried within 24 hours of placement, it shall be removed and replaced with drier fill.
- 2. Fill that is too dry for proper compaction shall receive water uniformly applied over the surface of the loose layer. Sufficient water shall be added to allow compaction to the required density.
- 3. In no case shall fill be placed over material that is frozen. No fill material shall be placed, spread or rolled during unfavorable weather conditions. When work is interrupted by heavy rains, fill operations shall not be resumed until the moisture content and the density of the previously placed fill are as specified.

C. Lift Thickness of Material

1. Structural Fill and Sand Borrow. Place in layers not to exceed 12 inches in thickness when utilizing heavy compaction equipment, and 6 inches when utilizing light hand-operated compaction equipment.
2. Common Fill. Place in layers not to exceed 12 inches in thickness when utilizing heavy compaction equipment, and 8 inches when utilizing light hand-operated compaction equipment.
3. Crushed Stone, Gravel, Dense, Graded Crushed Stone for Subbase. Place in layers not to exceed 9 inches in thickness when utilizing heavy compaction equipment, and 6 inches when utilizing light hand-operated compacted equipment. Compact with a minimum of 4 coverages of acceptable compaction equipment.

D. Placing Fill

1. Fill sections and embankments shall be constructed of earth, rock, or a mixture of earth and rock deposited in successive lifts. Except as hereinafter permitted, the loose thickness of each lift shall not be more than twelve (12) inches before compaction.
2. No rock in excess of six (6) inches in its largest dimension shall be incorporated in the top two (2) foot layer of embankment immediately below the subgrade.
3. During fill and embankment construction operations, earth moving equipment shall be routed as evenly as possible over the entire width of the work.
4. At the close of each day's work the working surface shall be crowned, shaped, and rolled with smooth steel or pneumatic tired rollers to ensure proper drainage.

E. Protection of Fill

1. Protection of compacted fill shall be the responsibility of the Contractor. Newly graded areas shall be protected from the actions of the elements and traffic. Any settlement or washing that occurs prior to acceptance of the work shall be repaired and grades shall be established to the required elevations and slopes. Damage to any compacted lift (including those lifts previously tested and approved by the Engineer) occurring at any time during the course of construction, which is caused by equipment, moisture entering the embankment, or from any other cause, shall be fully repaired by the Contractor prior to placement of overlying materials, at no additional cost to Owner and to the complete satisfaction of the Engineer.
2. In the event of and prior to the commencement of heavy rains, the Contractor shall suspend fill operations immediately and shall take all necessary steps to keep the site as well drained as possible. Fill operations shall not be resumed until the moisture content of the fill is such as to permit compliance with the Specifications.
3. All corrective work or operations necessary to maintain proper moisture control of the fill material shall be at the expense of the Contractor.

F. Grading Tolerances

1. Grading shall be completed to meet or exceed the following tolerances of uniformity*:

<u>Location</u>	<u>Tolerance</u>
Top of Subgrade Beneath Structures	1/2 inch
Top of Subgrade Beneath Paving	1/2 inch
Top of Subgrade Beneath Landscape Areas	1 inches
Top of Gravel and Gravel Bases	1/4 inch

*Uniformity is defined as no variations in the surface materials, at the grades and slopes indicated on the drawings, that exceed the listed tolerance over a length of ten (10) feet horizontally in any direction.

2. The bottom of earth and rock excavations shall be formed to provide a smooth, uniform slope and grade. The bottom of the excavated grade shall be free of pockets, depressions or ridges that would collect or concentrate water, silts or other such objectionable material prior to the Application of Backfill or other Finish Materials.

G. Finish

1. Upon completion of the work, ground surface shall be left in a firm, unyielding, true, uniform condition, free of ruts.

3.12 SHEETING AND BRACING

A. General

1. Whenever sheeting and bracing will be required, it shall be furnished and installed by the Contractor in accordance with the recommendations of Structural and Geotechnical Engineers engaged by the Contractor.
2. The Contractor shall engage licensed professional Structural and Geotechnical Engineers. These Engineers shall be licensed in the state where the work is occurring and they shall prepare designs for the sheeting and bracing.
3. Submit the sheeting and bracing designs to the Owner and the Engineer for the project record. The sheeting and bracing plans and calculations shall bear the professional seals and signatures of the Contractor's Engineers. These plans and calculations shall be submitted prior to the start of work.
4. The Contractor shall furnish and install the required sheeting and bracing in accord with the submitted designs. The Contractor shall include the costs for this work in his bid price for the project. No additional or separate compensation shall be allowed.

END OF SECTION

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SECTION 312500 – EROSION CONTROL

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This Section specifies requirements for temporary and permanent erosion control provisions as they relate to the construction process.
- B. The work includes:
 - 1. Providing and maintaining all temporary erosion control measures shown on the Drawings and required by the Engineer during the life of the Contract to control soil erosion and water pollution.
 - 2. The installation and maintenance of additional silt fence, berms, ditches, sedimentation basins, construction exits, fiber mats, catchbasin filters, straw, netting, gravel, trenches, mulches, grasses, slope drains and other approved erosion control devices or methods, needed to protect any areas on or off site in accordance with the Stormwater Pollution Prevention Plan (SWPPP) to be developed by the Contractor which is required by the EPA or it's locally designated agency.
 - 3. NPDES General Permit for Construction activities under EPA Regulations 40 CFR Parts 9, 122, 123 and 124 as applicable.

1.2 RELATED DOCUMENTS

- A. Other specification Sections which directly relate to the work of this Section include:
 - 1. Section 312300 – Excavation and Fill
 - 2. Section 311400 – Earth Stripping and Stockpiling

1.3 DEFINITION AND COORDINATION OF EROSION CONTROL REQUIREMENTS

- A. Permanent erosion control measures are defined as those elements that are to be incorporated into the final project product, including but not necessarily limited to such items as; finish paving and landscape, detention basin forebays, sedimentation control structures (Contech, Stormceptor, catch basins, etc.), swales and ditches, berms, and other such items.
- B. Temporary erosion control measures are defined as those elements that are required by permit approvals and necessary to be installed by the Contractor to meet Federal, State and Local regulations for the construction program, including, but not necessarily limited to, such items as; silt fences, berms, portable sedimentation basins, straw bales, check dams, and other such items, all of which shall be removed by the Contractor after installation of

permanent erosion control measures, stabilization of the site, and prior to final completion of the project.

- C. The temporary control provisions shall be coordinated with the permanent erosion control features to the extent practical to ensure economical, effective and continuous erosion control throughout the construction and post-construction period.

1.4 QUALITY ASSURANCE

- A. Compliance with the EPA NPDES Stormwater Regulations as described in Section 014129 is a responsibility of the Contractor.
- B. Local municipality standard details and specifications. Maintain one copy of each on site.

1.5 PRIOR TO CONSTRUCTION

- A. Install soil erosion and sediment control devices prior to any soil disturbance, or in proper sequence, and maintain until permanent protection/stabilization is established.
- B. Prior to the start of the construction, the Contractor shall submit to the Engineer: schedules for the construction of required stormwater detention basins, temporary and permanent erosion and sediment control work, clearing and grubbing, grading, structures at watercourses, construction, and paving. No work shall be started until control schedules and methods of operations have been submitted to the Engineer.
- C. Proof of submittal and receipt of an acknowledgement of the Notice of Intent for an NPDES General Permit for Construction Activities under EPA Regulations 40 CFR Parts 9, 122, 123 and 124 as further outlined in this section.

1.6 CONSTRUCTION OPERATIONS

- A. When in the opinion of the Engineer it becomes necessary, the Engineer will inform the Contractor of construction procedures and operations that jeopardize erosion and sedimentation control provisions. If these construction procedures and operations are not corrected promptly, the Owner may suspend the performance of any or all construction until corrections have been made, and such suspension shall not be the basis of any claim by the Contractor for additional compensation from the Owner nor for an extension of time to complete the Work.

1.7 CONTRACT DRAWINGS

- A. Conforming to Contract requirements, furnish and keep at the job site a set of Contract Documents, which illustrate proposed erosion control procedures.
- B. Clearly, neatly and accurately note on the designated set of the Contract Drawings all changes, revisions, and additions to the work.
- C. Update the designated set of the Contract Drawings promptly as work progresses.
- D. Furnish and keep posted at all times on the job site a copy of the Order of Conditions issued by the Conservation Commission.

July 11, 2018

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Temporary erosion control seed for quick growing grasses such as wheat, rye or oats shall be planted only when permanent grasses (See Landscape Specifications) cannot be planted due to the growing season. All permanent grass areas planted with temporary erosion control seed shall be replaced with permanent seed. Apply seed mixture at a rate of 100 pounds per acre.

Seed	% Weight	% Germination Minimum
Winter Rye	80 Minimum	85
Red Fescue (Creeping)	4 Minimum	80
Perennial Rye Grass	3 Minimum	90
Red Clover	3 Minimum	90
Other Crop Grass	0.5 Maximum	
Noxious Weed Seed	0.5 Maximum	
Inert Matter	1.0 Maximum	

- B. Silt fencing shall be used as one of the primary erosion control measures. Silt fence shall consist of a sheet of synthetic fabric such as polypropylene, nylon, polyester, or polyethylene yarn. Material shall be based on the synthetic fabric requirements as follows:
1. Filtering efficiency: 75% (minimum)
 2. Tensile strength: Standard strength: 30 lb./linear inch (minimum), Extra strength: 50 lb./linear inch (minimum)
 3. Elongation: 20% (maximum)
 4. Ultraviolet radiation: 90% (minimum)
 5. Slurry flow rate: 0.3 gal/ft²/min (minimum)
- E. Fiber rolls or an approved equal shall be used as another primary erosion control measures. Fiber rolls shall be used in conjunction with silt fences except when used for hillside erosion control, where they may be used alone.
- F. Gravel aprons shall be installed at the entrance of construction sites where disturbance is over 4,000 square feet to prevent sediment from the construction site entering the roadway. Aprons shall be a minimum of 15 feet in length, and extend the width of the entrance.
- G. Silt sacks (or equivalent) shall be placed in down gradient catch basins to prevent sediment from entering the drainage system. Silt sacks shall be periodically cleaned while in use and must be cleaned prior to and after precipitation events. Applicants are advised they may be required to respond immediately for repair and maintenance at the request of the Town within two hours of notification.
- H. All erosion and sediment controls shall remain in effective operating condition during construction activities. Inspect all erosion and sediment controls regularly and make the

necessary repairs or modifications to ensure effectiveness or as directed by the Town Inspector.

- I. Initiate soil stabilization measures immediately whenever earth-disturbing activities have permanently or temporarily ceased on any portion of the site. Complete soil stabilization measures as soon as practicable, but no later than 14 calendar days after the initiation of soil stabilization measures.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas in which work is to be performed. Notify in writing to the Engineer all prevailing conditions that will adversely affect satisfactory execution of work.
- B. Verify the locations of proposed erosion control measures.

3.2 SILT FENCE

- A. Silt fence shall be erected in a continuous fashion from a single roll of fabric. The bottom of the fabric fence shall be buried sufficiently below the ground surface to prevent gaps from forming, usually 4 to 6 inches below ground surface. The fabric shall be installed on the upstream side of the stakes. Stakes shall be strong enough and tall enough to securely anchor the fabric to the ground. Stake spacing shall be no more than 10 feet apart for extra-strength fabric and 6 feet apart for standard strength fabric. Maintenance of the fence is required during construction.

3.3 FIBER ROLLS

- A. Fiber rolls shall be trenched between 3 and 5 inches into the ground, depending on the size of the fiber roll. Fiber rolls shall be staked securely into the ground using wood stakes. A minimum of 3 inches of the stake shall stick out above the roll.
- B. Stakes shall be spaced 3 to 4 feet apart unless otherwise approved by the DPW. Erosion control mats shall be installed in accordance with the manufacturers recommendations.
- C. Fiber rolls placed around drain inlets shall be placed a minimum of one (1) foot back from the inlet.
- D. For slope stabilization, fiber rolls shall be placed perpendicular to the expected flow of stormwater runoff, with the following separation:

1:1 slopes = 10 feet apart

2:1 slopes = 20 feet apart

3:1 slopes = 30 feet apart

4:1 slopes = 40 feet apart

3.4 SILT FENCE

- A. Silt fence shall be installed at locations as shown on the Drawings.

July 11, 2018

- B. Supporting posts shall be spaced 4 feet on center, and driven at least one foot into the ground. Posts shall be 1-1/2 inch square or heavier wood posts, or standard steel posts.
- C. Fabric shall be anchored in a 4-inch deep trench dug on the upslope side of the posts. The trench shall be at least 4 inches wide. The fabric shall be laid in the trench, backfilled and compacted.
- D. Fabric rolls shall be spliced at posts. The fabric shall be overlapped 6 inches, folded over and securely fastened to posts.
- E. Silt fences shall be inspected immediately after each storm event and at least daily during prolonged rainfall.

3.5 SILT SACKS

- A. Silt sacks shall be placed at all catch basins and/or inlets to drainage structures (on-site and off-site according to the Drawings).

3.6 CONSTRUCTION REQUIREMENTS – TEMPORARY SEDIMENT CONTROL

- A. The Contractor shall construct all permanent erosion and sediment control features at the earliest practical time as outlined in the accepted schedule. Temporary erosion and sediment control measures shall be used to correct conditions that develop during construction which were unforeseen, but are needed prior to installation of permanent control features, or that are needed temporarily to control erosion or sedimentation which develops during construction operations.
- B. Where erosion is likely to be a problem, clearing and grubbing operations shall be scheduled and performed so that grading operations and permanent erosion and sediment control features can follow immediately thereafter, if conditions permit; otherwise, temporary control measures will be required between successive construction stages.
- C. Contractor shall be responsible for controlling erosion within the project area and retaining sediment on-site away from sensitive environmental resources. Any fines, construction delays, remedial actions, or incarceration resulting from the Contractor's failure to comply with these provisions shall be the responsibility of the Contractor and not the Owner.
- D. Failure by the Contractor to control erosion, pollution, and siltation shall be cause for the Owner to employ outside assistance to provide the necessary corrective measures. The cost of such assistance, including engineering costs, will be charged to the Contractor and appropriate deductions made to the Contractor's monthly progress payment request.
- E. The Contractor shall remove and properly dispose of sediment from control facilities as required by the Engineer. The Contractor shall modify and improve erosion and sedimentation control facilities and replace deteriorated straw bales and other devices as required by the Engineer.
- F. Minimum temporary and permanent erosion and sedimentation control measures are shown on the Drawings. The Contractor shall strictly adhere to the minimum provisions shown. Additionally, temporary measures shall be selected and constructed by the Contractor in consultation with the Engineer to accommodate changing field conditions that develop during construction.

- G. The temporary sedimentation basins shall be maintained from the start of construction until construction of the permanent detention basins and/or stormwater system is completed and perimeter areas are stabilized. A temporary outlet shall be constructed above the expected sediment levels. Construction of the basins shall be sequenced so that the temporary outlet is installed and basin embankment is constructed with the material available from the initial site excavations.
- H. Per NPDES requirements, in disturbed areas where construction has permanently or temporarily ceased, the area must be stabilized within 14 days. If earth disturbing activities will resume within 14 days, temporary stabilization is not required.
- I. All disturbed areas shall be re-vegetated by loaming and seeding unless otherwise noted on the approved plan.

3.7 MAINTENANCE OF EROSION CONTROL MEASURES

- A. The Contractor shall check the condition of erosion and sedimentation control devices daily and maintain them in good operating condition. Straw bales shall be replaced when deteriorated.
- B. The Contractor shall inspect the condition of diversion dikes and ditches, filter berms, interceptor dikes, sediment basins and other erosion and sedimentation control devices after each rainstorm and during major storm events. Repairs shall be made as necessary.
- C. During construction, temporary outlets of the drainage systems shall direct the flow to temporary or permanent sedimentation basins.
- D. Temporary soil erosion and sedimentation control devices shall be removed and adjacent areas outside the limits of grading restored upon completion of the work or when required by the Engineer.
- E. Erosion control problems created by the Contractor, and beyond the scope of work, shall be immediately corrected by the Contractor at no additional cost to the Owner.
- F. The Contractor shall follow all of the inspection and maintenance procedures described in the site SWPPP and other locally distributed permits or approvals.

END OF SECTION

Section 32 12 00
ASPHALT PAVING

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and Division 1 Specification Sections apply to work of this section.

1.2 DESCRIPTION OF WORK

- A. Furnish all materials, equipment, and labor to provide:
1. Asphalt-aggregate, central-plant, hot-mix, bituminous pavement.
 2. Bituminous berm.
- B. Related Sections:
1. Section 31 00 00 "Earthwork"

1.3 ENVIRONMENTAL CONDITIONS

- A. Bituminous paving shall not be placed when the ambient temperature is below 40 degrees F, or when there is frost in the base, or any other time when weather conditions are unsuitable for the type of material being placed.

1.4 PROTECTION

- A. After final rolling, no vehicular traffic of any kind shall be permitted on paving until it has cooled and hardened, and in no case less than 6 hours.
- B. Any damaged pavement resulting from work under this contract shall be repaired by the CONTRACTOR at no additional expense to the OWNER.

1.5 SUBMITTALS

- A. Product Data: Submit manufacturer's product data and installation instructions for each material and product used.
- B. Test Reports: Submit for approval test reports, list of materials, and gradations proposed for use.

1.6 QUALITY ASSURANCE

- A. Construction Tolerances:
1. Base Course Thickness: Within 1/4 inch.
 2. Surface Course Thickness: Within 1/4 inch.
 3. Base Course Surface Smoothness: Within 1/4 inch.
 4. Surface Course Surface Smoothness: Within 3/16 inch. No ponding acceptable.
 5. Crowned surfaces: Within 1/4 inch from template.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Bituminous Concrete Pavement shall be Class I, Type I-1 bituminous concrete pavement conforming to the Massachusetts DPW Standard Specifications Sections M3.11.01 through M3.11.08.

B. Asphalt:

1. The asphalt material shall conform to the requirements of the applicable table in "Specifications for Asphalt Cements and Liquid Asphalts", Specification Series No. 2, The Asphalt Institute. Paving asphalt shall be steam-refined paving asphalt with penetration grades of 85-100 for roads, and 60-70 for parking areas. The amount of asphalt to be mixed with the mineral aggregate shall be between 3-6 percent by weight for binder course and between 6.5-8 percent by weight for surface/finish course. The exact amount of asphalt to be mixed with the mineral aggregate shall be such that a hard, unyielding paving will be the result.

C. Mineral Aggregate:

1. Coarse and fine mineral aggregate shall consist of broken stone, crushed gravel, natural material having sufficient roughness when combined within the specified limits for grading, or a mixture thereof. If gravel is used, not less than 15 percent nor more than 30 percent limestone screenings by weight shall be added to the gravel as a separate ingredient so as to meet the gradation limits. If crushed stone is used, not less than 15 percent nor more than 30 percent sand by weight shall be added to the crushed stone as a separate ingredient to meet the gradation limits. The material shall be tough, durable, and sound, and shall be free from organic matter and other deleterious substances, and shall conform to the following gradation:

a. BINDER COURSE

BINDER COURSE	PERCENT PASSING
1 inch	100
3/4 inch	80-100
1/2 inch	55-75
No. 4	28-50
No. 8	20-38
No. 30	8-22
No. 50	5-15
No. 200	0-5
Bitumen	4.5-5.5

b. SURFACE/FINISH COURSE

SURFACE/FINISH COURSE	PERCENT PASSING
5/8 inch	100
1/2 inch	95-100
3/8 inch	80-100
No. 4	50-76
No. 8	37-54
No. 16	26-40
No. 30	17-29
No 50	10-21
No. 100	5-16
No. 200	2-7
Bitumen	5.5-7.0

- D. Prime Coat: Cut-back asphalt, ASTM D 2027.
- E. Tack Coat: Emulsified asphalt, ASTM D 977.
- F. Herbicide Treatment: commercial chemical for weed control registered by Environmental Protection Agency and acceptable to authorities having jurisdiction.
- G. Marking Paint: Alkyd-resin type, lead and chromate free, ready-mixed AASHTO M 248, Type *, white or yellow.

2.2 MIXING

- A. Bituminous pavement shall be mixed at a central mixing plant by either batch mixing or continuous mixing, at a temperature not exceeding 325 degrees F. The completed mixture, tested at any time or at any location, shall have a uniform distribution of asphalt binder, as determined by the extraction test, as performed in accordance with ASTM test method D2172.82. The bitumen ratio (pounds of asphalt per 100 pounds of dry aggregate), computed from laboratory extraction analysis, shall not vary more than 5 percent above or 10 percent below the exact amount predetermined to obtain hard unyielding paving.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Immediately before applying binder course, the area to be surfaced shall be cleaned of all loose material. Binder course shall not be applied until base course preparation has been completed, and only so far in advance of placing the surfacing as may be permitted by the ENGINEER.
- B. Surface Preparation: In advance of placing asphalt concrete, and before placing adjacent to cold transverse construction joints, such joints shall be trimmed to a vertical face and to a neat line.
- C. Spreading: The surface shall be clean of all dirt, packed soil, or any other foreign material, and shall be dry when spreading the bituminous mixture. The mixture shall be spread in two courses and to the amount required to obtain the compacted thickness and cross section shown on the design drawings. The mixture shall be spread without disturbing the base course and struck off so that the surface is smooth and true to cross section, free from all irregularities, and of uniform density throughout. Care shall be used in handling the mixture to avoid segregation. Areas of segregated mixture shall be removed and replaced with suitable mixture.

- D. Initial Rolling: The initial rolling shall consist of one complete coverage of asphalt mixtures and shall be performed with 3 wheel rollers or 2 wheel tandem rollers. Such rollers shall weigh not less than 12 tons. Rolling shall commence at the lower edge and shall progress toward the highest portion. Under no circumstances shall the center be rolled first. Rolling shall be performed with the drive wheel of the tandem roller forward with respect to the direction of spreading operations, unless otherwise permitted.
- E. Intermediate Rolling: The initial rolling shall be followed by additional rolling consisting of three complete coverages with an oscillating type pneumatic-tired roller developing at least 80 psi contact pressure while the temperature of the mixture is at, or above, 150 degrees F.
- F. Final Rolling: The final rolling of the uppermost layer of asphalt concrete shall be performed with either 2 or 3 wheel tandem rollers weighing not less than 10 tons. Rollers shall be operated at a speed of not more than 3 miles per hour and in a manner that will avoid cracking, pushing, or displacing the mixture during the compacting period. Rolling shall be continued until further compaction is obtained. All compacted mixtures shall have a density of not less than 95 percent of that obtained by a laboratory compaction of an identical mixture. The use of any equipment that leaves ridges, indentations, or other objectionable marks in the asphalt concrete shall be discontinued.
- G. Finish Surface: The complete surfacing shall be thoroughly compacted, smooth, and true to grade and cross section, and free from ruts, humps, depressions, or irregularities. When a straightedge 10 feet long is laid on the finished surface and parallel with the center line of the road, the surface shall not vary more than 3/16 of an inch from the lower edge of the straightedge. Any ridges, indentations or other objectionable marks left in the surface of the asphalt concrete by blading or other equipment shall be eliminated either by rolling or other means.
- H. Construct berms to dimensions indicated or, if not indicated, to standard shapes.
- I. Provide 4" lane and striping paint in uniform, straight lines.

3.2 SPECIAL INSTRUCTIONS

- A. In addition to the requirements of this specification, paving shall conform to all state and local regulations and specifications.

End of Section 32 12 00

SECTION 321613 – CURBS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This Section specifies requirements for furnishing and installing all types of granite, concrete and bituminous concrete curbs, edging and berms.
- B. The work includes:
 - 1. Furnishing and installing curb, granite edging, curb inlets, and curb corners.
 - 2. All associated items and operations required to complete the installations, including surface preparation, concrete support, jointing and finishing.

1.2 RELATED DOCUMENTS

- A. Other specification Sections which directly relate to the work of this Section include:
 - 1. Section 033000 - Cast-in-Place Concrete
 - 2. -
 - 3. Section 311400 – Earth Stripping and Stockpiling
 - 4. Section 312300 – Excavation and Fill
 - 5. Section 321200 – Asphalt Paving

1.3 REFERENCE STANDARDS

- A. References herein are made in accordance with the following abbreviations and, all work under this Section shall conform to the latest editions as applicable.
- B. ACI 304 – Recommended Practice for measuring, mixing, transporting and placing concrete.
- C. ANSI/ASTM D1751 – Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Non extruding and Resilient Bituminous Types).
- D. ANSI/ASTM D1752 – Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.
- E. ASTM C33 – Concrete Aggregates.
- F. ASTM C94 – Ready-Mixed Concrete.
- G. ASTM C150 – Portland Cement.
- H. ASTM C260 – Air-Entraining Admixtures for Concrete.

July 11, 2018

POPE'S TAVERN
ADDITION/RENOVATION
Halifax, Massachusetts

- I. ASTM C309 – Liquid Membrane-Forming Compounds for Curbing Concrete.
- J. ASTM C494 – Chemical Admixtures for Concrete.

1.4 SUBMITTALS

- A. Submit Shop Drawings and Manufacturer's literature for all types of curb, edging, corners and inlets, indicating size, shape and dimensions, finish and setting method for Engineer's approval.
- B. Copies of tests on samples of concrete used in the manufacture of precast units showing a compressive strength of 5,000 psi prior to shipping any units.
- C. As-Built Drawings
 - 1. As-Built Drawings shall indicate the true measurements and horizontal locations of the new curb construction. As-Built Drawings shall be stamped with the seal of a Licensed Land Surveyor.
 - 2. Submit a digital copy in a PDF and DWG format to the Engineer upon completion and acceptance of work prior to obtaining substantial completion certificate.
 - 3. Submit paper and mylar copies as required by the local municipality.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Granite and precast units shall be adequately protected from damage during transit to the site.
- B. Curbing shall be protected against staining, chipping, and other damage. Cracked, badly chipped, or stained units will be rejected and shall not be employed in the work.

1.6 SAMPLES

- A. The Contractor shall supply to the site three samples of all curb types for approval prior to ordering materials. Approved sample material may be used in the work upon approval by the Engineer.

PART 2 - PRODUCTS

2.1 GRANITE CURB

- A. Granite curb shall be basically light gray in color, free from seams and other structural imperfections or flaws which would impair its structural integrity, and of a smooth splitting appearance. Natural color variation characteristic of the deposit from which the curb is obtained will be permitted.
- B. Whenever curbing is sawed, all surfaces that are to be exposed shall be thoroughly cleaned and any iron rust or iron particles removed by sand blasting or other methods approved by the Engineer and any saw mark in excess of 1/8 inch shall be removed.
- C. Dimensions

1. The stones for the several types of granite curb shall be cut to the dimensions and curvature hereinafter needed:

<u>Type</u>	<u>Min. Length</u>	<u>Width at Top</u>	<u>Depth</u>	<u>Minimum Width at Bottom</u>
Highway	6 Feet	6 Inches	17 to 19 Inches	4 Inches (for 2/3 length)
Site	3 Feet	5 Inches	17 to 19 Inches	3-1/2 Inches (for 2/3 length)

Stones to be set on a radius of 100 feet or less shall be cut to the required curvature, unless otherwise approved and, except for making closures, shall be of the following minimum lengths:

<u>Radius</u>	<u>Minimum Length</u>
50 Feet to 100 Feet	6 Feet
25 Feet to less than 50 Feet	4 Feet 6 Inches
Less than 25 Feet	3 Feet

D. Finish

1. Granite curb shall have a top surface free from wind, shall be peen hammered or sawed to an approximately true plane, and shall have no projections or depressions greater than 1/8 inch. The front and back arris lines shall be pitched straight and true and there shall be no projection on the back surface for 3 inches down from the top which would exceed a batter of 3:1 (3 vertical:1 horizontal) when measures in the in-place position.

The front face shall be at right angles to the planes of the top and ends and shall be smooth quarry split, free from drill holes and with no projection of more than 1 inch and no depression of more than 1/2 inch measured from the vertical plane of the face through the arris or pitch line for a distance down from the top of 8 inches. For the remaining distance, there shall be no projection or depression greater than 1 inch measured in the same manner.

The ends of all stones shall be square with the planes of the top and face so that when the stones are placed end to end as closely as possible, no space shall show in the joint at the top and face of more than 1/2 inch for the full width of the top and for 8 inches down on the face; after which the end may break back not over 8 inches from the plane of the joint. The arris formed by the intersection of the plane of the joint with the planes of the top and exposed faces shall have no variation from the plane of the top and exposed faces greater than 1/8 inch.

2.2 BITUMINOUS CONCRETE CURB (FORMED)

- A. Bituminous concrete curb shall conform to the requirements for Dense Mix as specified in Section 321216 – Asphalt Paving and MassDOT Standard Section 501.

July 11, 2018

2.3 BITUMINOUS BERM

- A. Bituminous berm shall conform to MassDOT Standard Section 470.

2.4 CEMENT MORTAR

- A. Cement mortar shall be composed of one part Portland Cement and two parts of sand by volume with sufficient water to form a workable mix. Cement shall be Portland Cement Type II.

2.5 TRANSITION SECTIONS

Horizontal transition sections shall be provided at all locations where curb sections change (i.e., vertical to sloped). Vertical transition sections shall also be provided for precast curb sections at wheelchair ramps. Vertical transition sections for granite curb shall be made as shown on the Drawings.

PART 3 - EXECUTION

3.1 GENERAL

- A. Trenching, excavation, backfilling, and compaction shall be completed in accordance with Section 312300 – Excavation and Fill, except as modified within this Section.
- B. Cement mortar bedding, if required, shall be placed as shown on the drawings and in accordance with Section 033000 – Site Cast-in-Place Concrete.

3.2 GRANITE CURB INSTALLATION

- A. Excavation shall extend 6 inches below and behind curb, as shown on the Drawings.
 - 1. The gravel base shall be placed in the excavated area, graded and compacted to above the proposed curb subgrade.
- B. Curbing and curb corners shall be set on additional gravel spread upon the foundation. All spaces under the curb and curb corners shall be filled with gravel thoroughly compacted so that the curb and curb corners will be completely supported throughout their length. The curb shall be set at the line and grade required as shown on the plans unless otherwise directed.
- C. Curb or curb corners shall be fitted together as closely as possible.
- D. Immediately after the curb, curb corners, and curb inlets is set, the space between it and the wall of the trench shall be filled with gravel thoroughly tamped to a depth of 6 inches, care being taken not to affect the line or grade of the curb, curb corners, curb inlets and edging. The trench shall continue to be filled with gravel and compacted in 6-inch lifts until grade is achieved. If the curb materials and trench are part of reconstruction work and existing bituminous concrete surface is to remain, then the use of concrete backfill is acceptable, to an elevation suitable to support the pavement patch or section.
- E. The joints between curbstones (both front and back) shall be carefully filled with cement mortar and neatly pointed on the top and front exposed portions. After pointing, the curbstones or edging shall be satisfactorily cleaned of all excess mortar that may have been forced out of the joints.

- F. Transitions from normal curb settings to wheelchair ramps shall be accomplished with transition curb as shown on the drawings. Transitions shall be of the same type curb and similar to that abutting and, if on a curve, of the same radius.
- G. The ends of the stone curb at driveways and intersections shall be cut at a bevel or rounded, as shown on the Drawings.
- H. If curb, curb corners or curb inlets of different quarries is used on the same project, curbing of each particular quarry shall be segregated and set to give uniform appearance.
- I. Procedures for removal and resetting of existing granite curb, and new granite curb, in existing pavements shall include the following:
 - 1. Prior to excavation for existing granite curb removal, the pavement surface shall be saw cut a minimum of one foot from the face of curb.
 - 2. Existing curb shall be carefully excavated, and removed in a manner that protects the curb and existing pavement to remain from damage.
 - 3. Existing granite curb shall be cleaned by sandblasting as required to remove bituminous material, paint and concrete from exposed surfaces prior to resetting in the proposed work.

New granite curb shall be set to match the top of existing granite curb remaining in place at abutting sections and, if required, transitioned to the typical section shown on Drawings within the first section of curb. Cement concrete shall be placed along the front face of the curb as shown on the Drawings.

3.3 BITUMINOUS CONCRETE CURB AND BERM

A. General Requirements

- 1. Bituminous curb shall be constructed by the use of an approved self-propelled extruding curb machine equipped with a material hopper, distributing screw and curb forming device capable of placing the bituminous mixture to the required lines, grades and proper curb cross-section. Prior to the placement of any curb, the Contractor shall submit a detail of the cross-section of the curb mold to the Engineer for approval.

B. Surface Preparation

- 1. Before curbing is to be placed on pavement, the pavement surface shall be thoroughly swept and cleaned by mechanical sweepers and allowed to dry. If the curb is to be placed on cement concrete pavement, the concrete shall receive a coating of tack coat material prior to placement of the curb.

C. Placing and Compaction

- 1. The hot bituminous mixture shall be placed in the hopper of the curb paver without segregation and extruded through the mold form to provide the proper compaction and surface texture.

July 11, 2018

POPE'S TAVERN
ADDITION/RENOVATION
Halifax, Massachusetts

2. The curb paver shall be properly supported and weighted during operation along the edge of the pavement and shall be guided along string or chalk lines to maintain the proper alignment and level of the completed curb.
 3. Any portions of the completed curb, which are not satisfactorily compacted, show signs of sagging, cracking, and distortion, do not conform to the required lines, grades or cross section, and which cannot be satisfactorily repaired, shall be removed and replaced at no additional cost to the Owner.
- D. Joints: Bituminous curb construction shall be a continuous operation in one direction only without joints. When placing of the curb is discontinued for a length of time that permits the mixture to cool, the curb shall be cut in a true vertical plane and the exposed end painted with tack coat material just prior to placing the fresh curb mixture against the previously constructed curb to achieve a continuous bond.
- E. Curing: The newly completed curb shall be protected from traffic or other disturbance by barricades or other suitable methods until adequate stability has been obtained, but in no case less than twelve hours.

END OF SECTION

SECTION 321723 – PAVEMENT MARKINGS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This Section specifies requirements for removal of existing pavement markings and construction of new markings.
- B. The work includes:
 - 1. Removal of existing markings by approved methods
 - 2. Pavement surface preparation
 - 3. Furnishing and installing new pavement markings

1.2 RELATED DOCUMENTS

- A. Sections which directly relate to the work of this Section include:
 - 1. Section 312300 – Excavation and Fill
 - 2. Section 321200 – Asphalt Paving
 - 3. Section 321613 – Curbs

1.3 SITE CONDITIONS

- A. The Contractor shall cordon off areas where markings are being applied, but maintain access for vehicular and pedestrian traffic as required for other construction activities. Flagmen, barricades, drums, warning signs, warning lights and similar devices shall be used as required.

1.4 SUBMITTALS

- A. Submit material certificate to the Engineer, signed by the material producer and Contractor, certifying that materials comply with these specifications and have been approved for use by the Massachusetts Department of Transportation.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Existing pavement marking applications shall be placed in conformance with MassDOT Standard Section 860.
- B. For all new roadway construction, pavement markings shall be placed in conformance with MassDOT Engineering Directive E-05-003, dated June 16, 2005.

- C. Traffic markings shall be restored by end of day, either after removal or paving. Temporary markings are allowed.
- D. Traffic markings shall be - yellow or white Traffic Marking Paint as manufactured by Sherwin Williams Paints; "set fast" Acrylic Alkyd Traffic-Marking Paint Model # TM 2160 White or TM 2161 Yellow.

PART 3 - EXECUTION

3.1 PREPARATION

- A. The Contractor shall clean the pavement of dust, dirt, oil, grease, old pavement markings, concrete curing compounds and other foreign material which may be detrimental to the adhesion of the marking material.
- B. Asphalt (bituminous concrete pavement) shall be cured a minimum of 48 hours or at the direction of the Engineer before the application of pavement markings.
- C. Apply pavement marking only on thoroughly dry surfaces, when atmospheric temperature is above 50°F, when relative humidity is below 85 percent, and when weather is favorable.

3.2 PAVEMENT MARKING REMOVAL

- A. Existing pavement markings that conflict with the proposed markings, and those shown on the Drawings, shall be removed. Pavement markings shall be removed before any change is made in the traffic pattern. Any excessive damage to the pavement caused by pavement marking removal shall be repaired by the Contractor by methods acceptable to the Engineer at no additional cost to the Owner.
- B. Approved methods include:
 - 1. Sand blasting using air or water.
 - 2. High pressure water.
 - 3. Steam or superheated water.
 - 4. Mechanical devices such as grinders, sanders, scrapers, scarifiers and wire brushers.
- C. Painting over a pavement marking line with asphaltic liquids or paints will not be permitted, unless approved by the Engineer.
- D. Material deposited on the pavement from removal operations shall be removed as the work progresses. Accumulations of sand or other material which might interfere with drainage or could constitute a hazard to traffic will not be permitted.
- E. Where sand blasting is used for the removal of pavement markings and the removal operation is being performed within 10 feet of a lane occupied by traffic, the residue, including dust, shall be removed immediately as the marking removal progresses by a vacuum attachment operating concurrently with the blast cleaning operation, or by other methods approved by the Engineer.

3.3 PAVEMENT MARKING APPLICATION

- A. The material shall be applied to the pavement by equipment designed and manufactured specifically for the application of pavement markings.
- B. The Contractor shall employ the services of a Registered Land Surveyor to provide control for layout of pavement markings.
- C. Paint markings shall be applied at a minimum thickness of 15± 1 mil.
- D. Pavement markings shall be applied in accordance with the layout shown on the drawings. No markings shall be applied to new bituminous pavement until the top course has cured at least one week, and allow two weeks curing for newly installed bituminous concrete curbing.
- E. All parking stalls shall be single stripe, and shall be spaced equally. The line indicated on the Drawings is on the center line of the stall marking.
- F. Where entire areas are to be cross-hatched, the striping shall conform to the cross-hatching shown on the Drawings.
- G. All parking stall markings shall be straight with sharp corners and clean edges. Directional arrows, cross hatching, lane divider stripes, stop lines, and lettering shall be painted white to the size, length, and spacing shown on the Drawings.
- H. All markings shall be applied in one coat with brush, spray, or marking machine over dry clean pavement surfaces, when the atmospheric temperature is at or above 40°F and when the weather is otherwise favorable in the opinion of the Engineer. A second coat shall be applied after paint is thoroughly dry.
- I. Use only skilled workmen who are experienced and normally employed in the work of installing pavement markings. Supply all the necessary equipment and materials required for the work.
- J. The Contractor shall protect the buildings, walks, pavement, curbing, trees, shrubs, mulch and other site fixtures from over-spray of paint and damage from marking operations.
- K. Traffic shall not be permitted on the pavement until the paint is thoroughly dry.
- L. If for any reason paint is spilled or tracked on the pavement or any markings applied by the Contractor are, in the opinion of the Engineer, of incorrect width or pattern or fail to conform to the established line(s) of reference, Contractor shall remove such paint by a method that is not harmful to the pavement and is acceptable to the Engineer. The pavement surface shall then be cleaned and prepared for a reapplication of markings to be done without additional compensation to the Contractor.

END OF SECTION

July 11, 2018

POPE'S TAVERN
ADDITION/RENOVATION
Halifax, Massachusetts

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SECTION 331000 – WATER DISTRIBUTION PIPING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This Section specifies requirements for the proposed water system pipe, fittings appurtenances and services.
- B. The work includes:
 - 1. Furnishing and installation of water distribution pipe, valves and valve boxes, hydrants, pipe fittings, anchors, thrust restraints, required accessories and connections to existing water systems.
 - 2. Resetting existing hydrants and valve boxes to grade.
 - 3. Relocation of existing hydrants, valves and other appurtenances as required.
 - 4. Furnishing and installing meter pit, backflow prevention assembly, pressure-reducing valves and other related appurtenances.

1.2 RELATED DOCUMENTS

- A. Other specification Sections which directly relate to the work of this Section include:
 - 1. Section 033000 - Cast-in-Place Concrete
 - 2. Section 312300 – Excavation and Fill
 - 3. Section 331300 – Disinfection of Water Distribution System

1.3 STANDARDS

- A. AWWA – American Water Works Association.
- B. NFPA – National Fire Protection Association.

1.4 COORDINATION WITH THE MUNICIPALITY

- A. All work shall conform to the requirements of the local water authority, fire marshal, and other regulatory authorities having jurisdiction, or this specification, whichever is more stringent. Maintain one copy of each on site.
- B. The municipal Water Department shall be notified prior to starting construction of any portion of the municipal water system.
- C. The closing of valves necessary for making connections with existing municipal system will be done by the Water Department employees, assisted by the Contractor. Sufficient notice shall be given the Water Department of planned connection. No allowance will be made for

July 11, 2018

POPE'S TAVERN
ADDITION/RENOVATION
Halifax, Massachusetts

any delay in closing of valves. A 48-hour notice shall be given to residents or businesses affected by the shut-down, and shall be done by the Contractor under the direction of the Engineer.

The Water Department may require the work to be done at night during the low use time period.

1.5 SUBMITTALS

- A. Submit Shop Drawings or descriptive literature, or both, showing dimensions, joints and other details of all materials to be furnished. Shop Drawings shall be submitted to the Engineer for approval prior to ordering materials.
- B. As-Built Drawings
 - 1. As-Built Drawings shall be complete and shall indicate the true measurements and locations, horizontal and vertical, of all new construction. As-Built Drawings shall include a minimum of three ties to each gate valve box from fixed permanent objects. As-Built Drawings shall also contain any additional information required by the municipality, and shall be stamped with the seal of a Licensed Land Surveyor and Licensed Professional Engineer.
 - 2. Submit a digital copy in a PDF and DWG format to the Engineer upon completion and acceptance of work prior to obtaining substantial completion certificate.
 - 3. Submit paper and mylar copies as required by the local municipality.
- C. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Storage of pipe, fittings, valves, hydrants and other water line appurtenances on the site shall be in accordance with the manufacturer's recommendations, subject to the approval of the Engineer.
- B. Care shall be taken in loading, transporting and unloading to prevent injury to the pipe, fittings, valves, hydrants, and other water line appurtenances. Pipe or fittings shall not be dropped. All pipe or fittings shall be examined before laying and no piece shall be installed which is found to be defective. Any damage to pipe and fitting coatings shall be repaired as directed by the Engineer.
- C. Pipe, fittings, valves, hydrants and other water system appurtenances which are defective from any cause, including damage caused by handling, and determined by the Engineer as unrepairable, shall be unacceptable for installation and shall be replaced at no cost to the Owner.
- D. Pipe, and all water system appurtenances that are damaged or disturbed through any cause prior to acceptance of the work shall be repaired, realigned or replaced as required by the Engineer at no additional cost to the Owner.

1.7 LICENSED FIRE PROTECTION SPRINKLER SYSTEM CONTRACTORS

- A. Fire protection and fire control systems, including both overhead and underground water mains, fire hydrants and hydrant mains, standpipes and hose connections to sprinkler systems, sprinkler tank heaters, back flow preventers, air lines and thermal systems, hot water fire protection systems and standpipes connected to sprinkler systems, shall be installed by contractors and personnel appropriately licensed in the Commonwealth of Massachusetts per 528 CMR 12.00. Shop drawings required for submittals and reviews by the Engineer, or other legally recognized professional (M.G.L. c.112, Par. 81R) by 780 CMR 903.1.2 or by applicable NFPA Standards shall note the name(s), license number(s) and license expiration date(s) of the contractor(s) installing the fire protection system.

1.8 QUALITY ASSURANCE

A. Regulatory Requirements:

1. Comply with requirements of regulatory authorities having jurisdiction or the utility company supplying water including tapping of water mains, backflow prevention installation, testing, and disinfection.
2. Comply with standards of authorities having jurisdiction for potable-water-service piping, including materials, installation, testing, and disinfection.
3. Comply with standards of authorities having jurisdiction for fire-suppression water-service piping, including materials, hose threads, installation, and testing.

PART 2 - PRODUCTS

2.1 GENERAL

- A. The Drawings are diagrammatic only and are intended to indicate the extent, but not all details, of the system which shall be constructed. All materials are not shown; but the Contractor shall furnish and install all materials required for the complete system.
- B. All materials for the water distribution system shall be new and unused.

2.2 COPPER TUBING

- A. Copper Tubing: ASTM B88, Type K (underground) or as required by local utility owner, annealed:
 1. Fittings: ASME B16.18, cast copper, or ASME B16.22, wrought copper as required by local municipality.
 2. Joints: Compression connection or AWS A5.8, BCuP silver braze as required by local municipality.

2.3 DUCTILE IRON PIPE

- A. Ductile iron pipe shall be designed in accordance with ANSI A21.50/AWWA C150 and manufactured in accordance with ANSI A21.51/AWWA C151.
- B. Ductile iron pipe shall be Pressure Class 52 furnished in 18-foot or 20-foot nominal lengths.

- C. Pipes shall be cement-mortar lined in accordance with ANSI/AWWA C104/A21.4, except that the cement lining shall be double thickness. The interior of all pipes shall have a seal coat of asphaltic material applied over the cement lining in accordance with ANSI/AWWA C104/A21.4.
- D. The exterior of all pipe shall be factory coated with a double coat of asphaltic material conforming to ANSI/AWWA C151/A21.51.
- E. Restrained joint assemblies for mechanical fittings shall be EBAA Iron Sales MEGALUG or approved equivalent.

Restrained joint pipe shall be American Ductile Iron Pipe FLEX-RING Restrained Joint Pipe 4 inches – 12 inches, manufactured of ductile iron, all in accordance with ANSI/AWWA C151/A21.51, Pressure Rating 350 psi, or approved equivalent.

Restrained joint pipe shall be American Ductile Iron LOK RING Joint 14 inches – 24 inches manufactured of Ductile Iron, all in accordance with ANSI/AWWA C151/A21.51, Pressure Class 350 for sizes 4 inches through 24 inches or Pressure Class 250 for sizes 30 inches through 54 inches, or:

1. U.S. Pipe TR FLEX restrained push-on joint pipe 4 inches – 54 inches, manufactured in accordance with the requirements of ANSI/AWWA C141 A21.51, pressure class 350 for sizes 4 inches through 24 inches and pressure class 250 for sizes 30 inches through 54 inches.
2. U.S. Pipe FIELD LOK Gasket Instant Joint Restraint 4 inches – 24 inches, manufactured in accordance with the requirements of ANSI/AWWA C151/A21.51 for working pressure of 250 psi, or approved equivalent.

2.4 POLYVINYL CHLORIDE PIPE (PVC) PRESSURE PIPE (AWWA C-900)

- A. Pipe and Fittings for pressure systems shall be C900 polyvinyl chloride pipe (4-inch to 12-inch) as described in AWWA C-900. The pipe shall be plain end or gasket bell end, Pressure Class 150 (DR 18) with cast-iron-pipe-equivalent outside diameter. Fittings shall be gray iron or ductile iron, AWWA C110/A21.10 or AWWA C153/A21.53, and have cement-mortar lining, AWWA C104/A21.4, standard thickness. Fittings with push-on joint ends shall conform to the same requirements as fittings with mechanical-joint ends, except that bell design shall be modified, as approved, for push-on joint suitable for use with PVC pipe.
- B. Joints: Joints for pipe shall be push-on joints conforming to ASTM D3139. Joints between pipe and metal fittings, valves, and other accessories shall be push-on joints ASTM D3139, or compression-type joints/mechanical joints, ASTM D 3139 and AWWA C111/A21.11. Provide each joint connection with an elastomeric gasket suitable for the bell or coupling with which it is to be used. Gaskets for push-on joints for pipe shall conform to ASTM F477. Gaskets for push-on joints and compression-type joints/mechanical joints for joint connections between pipe and metal fittings, valves, and other accessories shall conform to AWWA C111/A21.11 for push-on joints and mechanical joints.

2.5 DUCTILE IRON PIPE FITTINGS

- A. All ductile iron pipe fittings shall conform to ANSI/AWWA C110/A21.10 gray and ductile iron standard fittings or ANSI/AWWA C153/A21.53-84 ductile iron compact fittings 3 inch through 16 inch. The ductile iron compact fittings shall be marked in accordance with Sec. 53-11,

which states that the fittings shall have distinctly cast on them the identity of this standard, C153; the pressure rating, 350 psi; nominal diameter of openings; manufacturer's identification; the country where cast; the letters "DI" or word "Ductile"; and the number of degrees or fraction of the circle on all bends.

- B. The type of fittings for pipe and valve connections shall be determined by the Contractor in accordance with the requirements shown on the Drawings prior to ordering the fittings.
- C. All fittings shall be cement-mortar lined and coated as specified for pipe.

2.6 DUCTILE IRON PIPE COUPLINGS

- A. Couplings and accessories shall be pressure rated at least equal to that of the pipe. Couplings shall be Smith Blair 471 style or approved equivalent. The couplings shall be provided with corrosion resistant nuts and bolts.
- B. Transition couplings for joining pipe of different diameters shall be Dresser Style 62 or approved equivalent. Coupling shall be provided with corrosion resistant nuts and bolts.
- C. After assembly, all exterior surfaces including the bolts and nuts shall be completely coated with two coats of a heavy-duty protective asphaltic coating. The interior of the coupling shall be epoxy-coated. Epoxy coating shall conform to AWWA C550.

2.7 DUCTILE IRON PIPE JOINTS

- A. Joints shall be either push-on or mechanical joints conforming to ANSI A21.11/AWWA C111. Push-on and mechanical joints shall be provided with required gaskets, lubricants and accessories conforming to ANSI A21.11/AWWA C111.

2.8 POLYETHYLENE ENCASEMENT

NOT USED

2.9 GATE VALVES

- A. Gate valves shall be resilient seated conforming to the requirements of AWWA C509 or AWWA C515, parallel, inclined or solid wedge type valves conforming to the requirements of AWWA Standard C500, of the type used by the municipal Water Department/
- B. Gate valves shall be cast iron body, bronze mounted, resilient wedge, non-rising stem with O-ring type stuffing box for valves 3 inches to 16 inches size.
- C. Gate valves shall open to the left (counterclockwise) and have mechanical joints.
- D. The Town of Framingham has standardized on American Flow Control and Kennedy.
- E. Bolts, studs and nuts shall be made from a corrosion-resistant material such as low-zinc bronze, nickel copper alloy, or stainless steel.
- F. Operating nut shall be 2 inches square at the base, tapering to 1-15/16 inches square at the top.

- G. Post indicator valves, when indicated on the drawings, are used to actuate and indicate the opened or closed status of the installed valve and indicator posts shall be listed by Underwriter's Laboratories, Inc. (UL) and approved by Factory Mutual Research (FM) and shall be of a manufacturer approved by the local utility company.

2.10 BUTTERFLY VALVES

NOT USED

2.11 VALVE BOXES

- A. Each gate valve shall be provided with a heavy-duty valve box and cover.
- B. Boxes shall be manufactured by Bibby Ste.-Croix or approved equal.
- C. Valve boxes shall be of the adjustable, telescoping, heavy-pattern type designed and constructed to prevent the direct transmission of traffic loads to the pipe or valve.
- D. Valve boxes shall be cast iron, asphalt coated with cast iron or steel covers. The smallest inside diameter of the shaft shall not be less than 5-1/4 inches. The lower section of the box shall be designed to enclose the operating nut and stuffing box of the valve. Provisions shall be made for adjustment through at least 6-inches vertically while retaining a lap of at least 4 inches between sections.
- E. Covers shall be close fitting and substantially dirt-tight. The top of the cover shall be flush with the top of the box rim. Boxes shall be labeled to differentiate between division valves ("DIV"), Blow-Off ("B.O.") and generic valves as indicated in the Framingham Construction Details. Box covers shall have a minimum height of four (4) inches.

2.12 HYDRANTS

- A. Hydrants shall include:

Make and Model: American Darling Model No. B-62B as manufactured by American Flow Control, Inc.

Type of Thread: National Standard Thread (NST)

Number of Outlets: 2 – 2-1/2 inch hose connection
1 – 4-1/2 inch steamer connection

Diameter of Opening: 5-1/4 inch

Size and Type of Inlet Connection: 6 inch mechanical joint

Direction of Opening: Open left (counter clockwise)

Depth of Cover: Same as required for pipe

Size and Shape of Operating Nut: Pentagonal, 1-1/2 inches, Open left (counter clockwise)

- B. Hydrant shall conform the requirements of ANSI/AWWA C502, latest issue.

- C. Bolts and nuts shall be made from a corrosion-resistant material.
- D. Hydrants shall be given two coats of primer paint before shipment. Contractor shall field paint hydrants red, with Sherman-Williams brand paint, after installation and according to the following Framingham specifications:
 - 1. Hydrant Body: Hydrant blue b54tz104
 - 2. Caps: Pure White b54w2101

2.13 TAPPING SLEEVE AND VALVE

- A. Tapping sleeves shall meet the requirements of AWWA standards and be of mechanical joint outlet with non-rising stem and designed for vertical burial. The tapping sleeves shall be suitable for a working water pressure of 200 psi and tested at 300 psi. Bolts on bonnet and stuffing box shall be stainless steel (316 stainless steel), stuffing boxes shall be "O" ring type. The operating nut shall be 2 inches square. Gaskets shall cover the entire flange surface. Valves shall open left (counter clockwise). The tapping sleeve and valve shall be the American Darling 1004 or an approved equivalent. Tapping sleeves shall be no greater than one-half of the diameter of the main being tapped.

2.14 THRUST RESTRAINTS

- A. Thrust restraints (cement concrete thrust blocks, clamps and tie rods, and restrained joints) shall be installed in accordance with the details shown on the Drawings and per manufacturer's recommendations.
- B. The Contractor shall discuss with the Engineer the method(s) to be used to restrain thrust prior to installing fittings and hydrant. Test pits may be required in areas of existing utilities to determine the exact location and dimensions of thrust restraints required.
- C. Concrete for thrust blocks shall have a minimum 28 day compressive strength of 3,000 psi.

2.15 CORPORATION STOPS AND CURB STOPS

- A. Corporations for 1 inch installations shall be heavy pattern, solid plug, easy turning. The inlet shall be an AWWA (CC) thread. The 1-1/2 inch and 2 inch corporations shall be of a tee head ball valve type which incorporates Teflon seats to assure self-centering of Teflon coated bronze ball. The corporation shall be easy turning and non-binding. The inlet shall be an AWWA (CC) thread. Corporations shall be subject to a sustained hydraulic pressure of 200 psi. All 1¹/₂ and 2-inch saddles shall have stainless steel straps.

2.16 SERVICE BOXES

- A. Service boxes shall be cast iron improved extension type with arch pattern base. Covers shall be held in place with bronze bolts and the word WATER shall be cast into the top surface of the cover. Service box shafts shall have a minimum inside diameter of 2-1/2 inches. Service boxes shall be Erie box style for 1-inch services and Buffalo box style (no rod) for 1-1/2-inch and larger services, as manufactured by Mueller Corp. or approved equivalent.

2.17 WATER SERVICE

July 11, 2018

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- A. All service pipe shall be type "K" copper tubing. All services shall have the valve box installed at the corporation on the main.
 - B. Plastic services are allowed on a case-by-case basis. In such circumstances, the Town will require that the applicant verify that no petroleum constituents are present in subsurface soil in the vicinity of the service. Plastic water services shall be NSW-PW, listed, High Density Polyethylene (HDPE) blue plastic and shall conform to the following:
 - 1. Copper Tube Size (CTS) – ASTM 2737, 200 psi, PE 3608 or PE 3710, SDR9
 - 2. Iron Pipe Size (IPS) – ASTM 2239, 200 psi, PE 3608 or PE 3710, SDR7

Plastic pipe shall be as manufactured by Silver Line Plastics or approved equal. Dimensional and performance characteristics shall conform to the requirements of AWWA C901. The use of HDPE pipe and tubing may be allowed for water service - two (2) inches or under in diameter (4-inch and larger diameter water services shall use cement lined ductile iron water pipe). HDPE pipe shall be installed with enough slack to compensate for settlement and compaction and shall be laid on a bed of fine grained material.

- C. Curb valves shall not include a drain.
- D. The Town has standardized on lead-free service connections manufactured by McDonald, Mueller, Ford or an approved equal. Copper tubing shall be of the type commercially known as type "K" soft and conforms to ASTM Specifications B-88-49.
- E. Curb boxes shall be Erie box style for 1-inch services and Buffalo box style (no rod) for 1-1/2-inch and larger services.

2.18 UNDERGROUND PIPE INSULATION

- A. Whenever called for on the Drawings, or required for close clearance on structures, provide factory pre-insulated piping systems.
- B. Casing pipe shall be PVC, ASTM D1784.
- C. Insulation shall be polyurethane closed cell foam completely encapsulated on each pipe segment by a heat resistant compressed rubber seal.
- D. Manufacturer shall be Thermal Pipe Systems, "Duc-Tite" for use with Ductile Iron water pipe.

2.19 METER PITS/VAULTS

NOT USED

2.20 BACKFLOW PREVENTERS

NOT USED

2.21 PRESSURE REDUCING VALVES AND AIR/VACUUM RELEASE VALVES

NOT USED

2.22 METERS

NOT USED

PART 3 - EXECUTION

3.1 GENERAL

- A. All water pipes, fittings, valves, hydrants and other appurtenances shall be installed at the locations as shown on the Drawings.
- B. The proposed location, and vertical alignment may be altered to avoid conflicts with existing and proposed utilities, as approved by the Engineer.
- C. Contractor to verify the location, size, invert and type of existing pipes at all points of connection prior to ordering new utility materials.
- D. Contractor to verify building service connection and municipal utility water main size, location, and invert are as indicated on Drawings.
- E. Contractor to maintain a sanitary condition within the inside of pipes, fittings, jointing materials, valves, etc., which will come into contact with potable water.

3.2 LAYING DUCTILE IRON PIPE AND FITTINGS

- A. Ductile iron pipe and fittings shall be installed in accordance with the requirements of ANSI/AWWA C600.
- B. Each length of pipe shall be laid with firm, full and even bearing throughout its entire length, in a trench prepared and maintained in accordance with Section 312300 – Excavation and Backfill. The type of materials to be used in bedding and backfilling and method of placement shall conform to the requirements of Section 312300 – Excavation and Backfill.
- C. All pipe shall be clean before laying. When laying is stopped for any reason, the open ends of the pipe shall be closed by watertight plugs or other approved means. If water is in the trench when work is resumed, the plug shall not be removed until the trench has been dewatered and all danger of water entering the pipe has been eliminated.
- D. Fittings, in addition to those shown on the Drawings, shall be provided if required to avoid utility conflicts.
- E. When cutting of pipe is required, the cutting shall be done by machine, leaving a smooth cut at right angles to the axis of the pipe. Cut ends of pipe to be used with a push-on bell shall be beveled to conform to the manufactured spigot end. Cement lining shall be undamaged.
- F. Maximum allowable deflection for pipe laid without fittings shall not exceed the allowable amount established by the pipe manufacturer and shall not exceed those shown in AWWA C600.
- G. The pipe shall be laid with a minimum cover of 5 feet per municipality requirements, below finished grade.

- H. All piping shall be laid in the dry with the spigot ends pointing in the direction of flow. Installation shall proceed from the downstream to upstream in all cases.
- I. Install access fittings to permit disinfection of water system performed under Section 331300 – Disinfecting of Water Utility Distribution.

3.3 JOINTING DUCTILE IRON PIPE

- A. Push-on joints shall be made in strict accordance with the manufacturer's instructions. A rubber gasket shall be inserted in the groove of the bell end of the pipe and the joint surface cleaned and lubricated using the pipe manufacturer's suggested methods and materials. The plain end of the pipe to be laid shall be inserted in alignment with the bell of the pipe to which it is to be jointed and pushed home with a jack or by other means. After joining the pipe, a metal feeler gauge shall be used to make certain that the rubber gasket is correctly located and has not been twisted or otherwise displaced.

3.4 JOINTING MECHANICAL JOINT PIPE AND FITTINGS

- A. Mechanical joints shall be made in strict accordance with the manufacturer's instructions. Mechanical joints shall be made by first cleaning the surfaces against which the gaskets will come in contact with a wire brush. The gasket, bell, and spigot shall be lubricated by washing with soapy water just prior to assembling the joint. After the nuts have been made up finger tight, the bottom nut, then top and then diametrically opposite nuts shall be progressively tightened. Bolts shall be tightened to the torques listed:

Bolt Size	Range of Torque
<u>(Inches)</u>	<u>(Feet-Pounds)</u>
5/8	45 - 60
3/4	75 - 90
1 inch	85 – 100

Under no conditions shall extension wrenches or a pipe over the handle of an ordinary ratchet wrench be used to secure greater leverage. After installation, a heavy bitumastic coating shall be applied to all bolts and nuts.

Restraining device shall be ductile iron and shall have dimensions such that it can be used with the standardized mechanical joint bell and tee-head bolts conforming to ANSI/AWWA A21.11 and ANSI/AWWA C153 latest revision.

3.5 LAYING OF PVC WATER PIPE

NOT USED

3.6 CONCRETE THRUST BLOCKS

- A. Where pipes change horizontal and vertical direction, at hydrants, tees and other fittings, and wherever abnormal thrust forces may be developed, the Contractor shall construct thrust and anchor blocks as detailed on the Drawings. They shall be concrete, of minimum dimensions

as detailed on the Drawings or of adequate additional size to suit actual conditions to withstand pressures anticipated, and shall be founded in undisturbed soil.

- B. Concrete for thrust blocks shall have a minimum 28 day's compressive strength of 3,000 psi.
- C. Fittings which do not use thrust blocks resting against natural occurring material with passive resistance pressure of 1,500 psf shall be installed with a restrained joint system as specified in Section 3.07.

3.7 RESTRAINED JOINTS

- A. Pipe with restrained joints shall be installed in all areas where the pipe is within fill materials and also at locations shown on the Drawings. Restrained joints shall be installed at bends, reducers, tees, valves, dead ends, and hydrants. The minimum length of pipe to be restrained on either side of the joint shall be as shown on the table below. The fittings of the new piping shall be for restrained joints, as marked on the Drawings.

<u>Fitting:</u>	Number of Joints to Restraint on Either Side of Fitting <u>(Based on 18-Foot Pipe Length)</u>
90 degree bend	3
45 degree bend	2
22-1/2 degree bend	2
<u>Tee:</u>	
Branch	3
Run	2

- B. No restraining is required in the direction of the existing pipe if only a short length of it is exposed in the trench for making a connection.
- C. Restrained joint assemblies for push-on pipe and fittings shall be made in strict accordance with the manufacturer's recommended installation procedures.
- D. Restrained joint assemblies for mechanical joint pipe shall be EBAA Iron Sales MEGALUG or approved equivalent.

3.8 WATER AND SEWER SEPARATION

When a sewer pipe crosses above or below a water pipe, the following procedures shall be utilized. The Contractor shall comply with these following procedures:

A. Relation to Water Mains

1. *Horizontal Separation:* Whenever possible sewers shall be laid at a minimum at least 10 feet, horizontally, from any existing or proposed water main. Should local conditions

prevent a lateral separation of 10 feet, a sewer may be laid closer than 10 feet to a water main if:

- i. It is laid in a separate trench, or if;
- ii. It is laid in the same trench with the water mains located at one side on a bench of undisturbed earth, and if;
- iii. In either case, the elevations of the top (crown) of the sewer is at least 18 inches below the bottom (invert) of the water main.

2. *Vertical Separation:* Whenever sewers must cross under water mains, the sewer shall be laid at such an elevation that the top of the sewer is at least 18 inches below the bottom of the water main. When the elevation of the sewer cannot be varied to meet the above requirements, the water main shall be relocated to provide this separation or reconstructed with mechanical-joint pipe for a distance of 10 feet on each side of the sewer. On full length of water main should be centered over the sewer so that both joints will be as far from the sewer as possible.

When it is impossible to obtain horizontal and/or vertical separation as stipulated above, both the water main and sewer shall be constructed of mechanical-joint cement lined ductile iron pipe or other equivalent based on water tightness and structural soundness. Both pipes shall be pressure tested by an approved method to assure water tightness or both pipes shall be encased in concrete.

3.9 GATE VALVE AND BOXES

- A. Valves shall be set in firmly compacted and shaped soil. Where the soil in the trench subgrade is found to be soft, loose, freshly filled earth, unstable or unsuitable as a base, the unsuitable material shall be excavated to such additional depth and width as required. The excavated area shall be backfilled with gravel or crushed stone, compacted and shaped.
- B. Valve boxes shall be set centered and plumb over the operating nuts of all valves. The top of each valve box shall be set to finished grade with at least 10 inches of overlap remaining between the upper sections for vertical adjustment. Minimum overlap for lower, extension pieces shall be 4 inches.
- C. Boxes shall be adequately supported during backfilling to maintain vertical alignment.

3.10 TAPPING SLEEVES AND GATE VALVES

- A. Installation shall be made under pressure and the flow of water through the existing pipe shall be maintained at all times. The diameter of the tap shall be a minimum of 1/4 inch less than the inside diameter of the branch line.
- B. The entire operation shall be conducted by workmen thoroughly experienced in the installation of tapping sleeves and valves, and under supervision of qualified personnel furnished by the manufacturer. The tapping machine shall be furnished by the Contractor.
- C. The Contractor shall determine the location of the existing pipe to be tapped to confirm that interference will not be encountered from existing utilities or a joint or a fitting. No tap shall be made closer than 3 feet from a pipe joint.

July 11, 2018

POPE'S TAVERN
ADDITION/RENOVATION
Halifax, Massachusetts

- D. Pipe upon which tapping sleeve is to be installed shall be thoroughly cleaned of all foreign matter with scraping tools and wire brushes to a minimum of six inches beyond each side of the sleeve. The cleaned area shall be washed with a hypochlorite solution. The interior of tapping valve shall also be washed with hypochlorite solution.
- E. Tapping sleeves and valves with boxes shall be set vertically and squarely centered on the pipe to be tapped. Adequate support shall be provided under the sleeve and valve during the tapping operation. Thrust blocks shall be provided behind all tapping sleeves. The supporting earth around and under the valve and sleeve shall be compacted. After completing the tap, the valve shall be flushed to ensure that the valve set is clean.
- F. Before backfilling, all exposed portions of any bolts used to hold the two halves of the sleeve together shall be heavily coated with two coats of bituminous paint equivalent to Bitumastic No. 50, by Kopper Company, Inc.

3.11 HYDRANTS

- A. Hydrants shall be installed at the locations and in conformance with the details shown on the drawings.
- B. Each hydrant shall be set vertically and be properly braced. Hydrants shall be installed with thrust blocks or restrained joints as specified in Articles 3.06 and 3.07. Care shall be taken to ensure that thrust block concrete does not plug the drain ports.

3.12 WATER SERVICES

- A. Service Pipe: Care shall be exercised in placing and laying of services to prevent kinks or sharp bends and contact with sharp stones or ledge which would damage to the pipe. At least 6 inches of sand shall be placed adjacent to, under, and above the pipe, and no stone larger than 2 inches shall be placed over the pipe until the depth of backfill above the pipe is in excess of 1 foot.
- B. Corporation Stop: Taps to the pipe shall be threaded and shall be made at the horizontal diameter of the main. The tap shall be made by means of a tapping machine manufactured for this purpose and supplied by the Contractor. The tap and drill shall be kept sharp and shall have threads matching those of the stop. Corporation stop threads shall be coated with sealing compound and the stop screwed firmly into the water with the key upward and the inlet end projecting at least 1/8-inch beyond the inside face of the pipe. Corporation stop shall be left in the on open position after installation of the service pipe.
- C. Curb Stop and Curb Boxes shall be of a size equal to the size of the service pipe and shall be installed in the locations shown on the Drawings or as ordered by the Engineer. The boxes shall be set in a vertical position and flush with the proposed finish grade.
- D. Ductile Iron Service Pipe: ductile iron service pipe connections to the water pipe shall be made with tee fittings or tapping sleeves.

3.13 SEPARATION FROM STRUCTURES

- A. Whenever possible, water pipes shall maintain a minimum distance of three (3) feet from underground adjacent unheated structures, such as manholes, catch basins, retaining walls, bridge abutments, parking garages, etc.

July 11, 2018

POPE'S TAVERN
ADDITION/RENOVATION
Halifax, Massachusetts

- B. When spacing under A. above is not possible, Contractor shall provide insulated water pipe for a minimum of three (3) feet beyond the limits of the adjacent structure.

3.14 POLYETHYLENE ENCASEMENT

NOT USED

3.15 PRESSURE AND LEAKAGE TEST

- A. The pressure and leakage tests shall be as specified in Section 301.60.L of the Massachusetts Department of Transportation Standard Specification For Highway and Bridges, AWWA Standard C600, Section 4.11 and NFPA standard for underground sprinkler piping. In general, the water pipe shall be given a pressure and leakage test in sections of approved length. For these tests, the Contractor shall provide a method of determining the exact amount of water being pumped into the test section and a pressure gauge. The Contractor shall also furnish and install suitable temporary testing plugs or caps for the pipeline; all necessary pressure pumping, pipe connections and other similar equipment; and all labor required; all without additional compensation. Prices for the appropriate pipe items shall include compensation for testing. The test equipment shall be installed by the Contractor in such a manner that all water entering the section under test will be measured and the pressure in the section indicated and they shall be kept in use during all tests. The scheduling of pressure and leakage tests shall be attended and approved by a representative of the local water department. Unless it has already been done, the section of pipe to be tested shall be filled with water of approved quality, and all air shall be expelled from the pipe.
- B. If tests indicate work does not meet specified requirements, remove work, replace and retest, with no additional compensation.

END OF SECTION

SECTION 331300 – DISINFECTING OF WATER UTILITY DISTRIBUTION

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This Section specifies requirements for the proposed water system pipe, fittings appurtenances and services.
- B. The work includes:
 - 1. Disinfecting and testing of the system.

1.2 RELATED DOCUMENTS

- A. Other specification Sections which directly relate to the work of this Section include:
 - 1. Section 033000 - Cast-in-Place Concrete
 - 2. Section 312300 – Excavation and Fill
 - 3. Section 331000 – Water Distribution Piping
 - 4. Town of Framingham Department of Public Works (DPW) Construction Standards – March 2009 (REV. March 2016)

1.3 STANDARDS

- A. AWWA – American Water Works Association.
- B. NFPA – National Fire Protection Association.

1.4 COORDINATION WITH THE MUNICIPALITY

- A. All work shall conform to the requirements of the local water authority and other regulatory authorities having jurisdiction, or this specification, whichever is more stringent. Maintain one copy of each on site.
- B. The Framingham Water Department shall be notified prior to any construction, disinfection, or testing of any portion of the municipal water system.
- C. The closing of valves necessary for making connections with existing municipal system will be done by the Water Department employees, assisted by the Contractor. Sufficient notice shall be given the Water Department of planned connection. No allowance will be made for any delay in closing of valves. A 48-hour notice shall be given to residents or businesses affected by the shut-down, and shall be done by the Contractor under the direction of the Engineer.

The Water Department may require the work to be done at night during the low use time period.

1.5 SUBMITTALS

July 11, 2018

POPE'S TAVERN
ADDITION/RENOVATION
Halifax, Massachusetts

- A. Furnish two copies to the Engineer of a Certificate of Disinfection Report and/or approval from state and local inspection authorities having jurisdiction indicating the installed systems compliance to their requirements.
- B. Furnish two copies to the Engineer of the results of the pressure testing conducted by a certified independent water testing company.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

3.1 GENERAL

- A. The Contractor shall furnish all apparatus; material and labor necessary for making the tests, including caps temporarily set to accommodate pressure testing.
- B. The Contractor shall furnish and install suitable temporary testing plugs, caps, pumps, pipe connections and other appurtenances as necessary and all labor required for testing bacteria and disinfecting the water mains.

3.2 DISINFECTION

- A. Before being placed in service, all new water pipe shall be chlorinated in accordance with ANSI/AWWA C651 Standard for Disinfecting Water Mains.
- B. The location of the chlorination and sampling points will be determined by the Engineer in the field. Taps for chlorination and sampling shall be installed by the Contractor. The Contractor shall uncover and backfill the taps as required.
- C. The pipe section being disinfected shall be flushed to remove discolored water and sediment from the pipe. A 25 mg/l chlorine solution in approved dosages shall be inserted through a tap at one end while water is being withdrawn at the other end of the pipe section. The chlorine concentration in the water in the pipe shall be maintained at a minimum 25 mg/l available chlorine during filling. To assure that this concentration is maintained, the chlorine residual shall be measured at regular intervals in accordance with procedures described in Standard Methods and AWWA M12, Simplified Procedure for Water Examination, Section K.
- D. During the application of the chlorine, valves shall be manipulated to prevent the treatment dosage from flowing back into the pipe supplying the water. Chlorine application shall not cease until the entire pipe section is filled with chlorine solution. The chlorinated water shall be retained in the pipe for at least a twenty-four hour period. The treated water shall contain a chlorine residual throughout the length of the pipe section as indicated in AWWA C651.
- E. Following the chlorination period, all treated water shall be flushed from the pipe section and replaced with water from the distribution system. Prior to disposal of treated water the Contractor shall check with local authorities to determine if the discharge will cause damage to the receiving body or sewer and, if required, the Contractor shall neutralize the chlorinated water in accordance with Appendix B, AWWA C650. Bacteriological sampling and analysis of the replacement water may then be made by the Contractor in full accordance with AWWA Specification C651. A minimum of three samples shall be taken by the Contractor at locations directed by the Engineer along the length of water pipe being chlorinated and sent

to a State approved private laboratory for analyses. The Contractor shall rechlorine if the samples show presence of coliform, and the pipe section shall not be placed in service until all of the repeat samples show no presence of coliform.

- F. Furnish two copies of a Certificate of Disinfection Report to the Engineer.
- G. Legally dispose of chlorinated water according to local and state regulations. When chlorinated discharge may cause damage to environment, apply neutralizing chemical to chlorinated water to neutralize chlorine residual remaining in water.
- H. The Contractor shall pay all costs for all testing, flushing, chlorinating; laboratory analyses, sampling, water supply and municipal charges.

3.3 PRESSURE TESTING

- A. Hydrostatic and leakage test shall be conducted in accordance with AWWA Standard C600, and NFPA 24, Standards, except it shall meet the leakage rates stated in Item D below as directed by the Engineer. Testing shall be conducted by a certified independent water testing company.
- B. Conduct pipe tests after concrete thrust blocks have cured to the required 3000 psi strength. Fill pipe 24 hours prior to testing, and apply test pressure to stabilize system. Use only potable water.
- C. Prior to pressure testing, the entire pipe section shall be flushed to remove any rocks or debris which may have inadvertently entered the pipe during construction.
- D. Once the pipe section has been filled at normal pressure and all entrapped air removed, the Contractor shall raise the pressure to 200 psi or two times the operating pressure (whichever is greater) by a special pressure pump, taking water from a small tank of proper dimensions for satisfactorily measuring the rate of water pumped into the pipe. This pressure shall be maintained for a minimum of 2 hours, during which time the line shall be checked for leaks. Measured rate of water leakage shall not exceed the allowable leakage as follows:
 - 1. Domestic water service pipes only, without attached fire service supply: meet latest edition of AWWA C600 series leakage requirements for the type of pipe being installed.
 - 2. Fire protection piping and domestic water service pipe with attached fire service piping: meet latest edition of NFPA 24 leakage requirements or latest edition of AWWA C600 series leakage requirements for the type of pipe being installed, whichever criteria are more stringent.
 - 3. Interior piping in vaults, buildings, etc. shall have zero leakage.
 - 4. Should leakage exceed the above rates, the Contractor shall immediately locate the leak or leaks and repair them. Pipe will be accepted only when leakage is zero, or less than the allowable amount. Approval does not absolve the Contractor from responsibility if leaks develop later within the period of warranty.

END OF SECTION

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SECTION 333100 – SANITARY UTILITY SEWERAGE PIPING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This Section specifies requirements for a gravity flow sewerage system.
- B. The work includes furnishing and installing all pipes, fittings, cleanouts and appurtenances required for the proposed system to convey sewage by gravity flow conditions.

1.2 RELATED DOCUMENTS

- A. Sections which directly relate to the work of this Section include:
 - 1. Section 033000 - Cast-in-Place Concrete
 - 2. Section 312300 – Excavation and Fill
 - 3. Section 333900 – Sanitary Utility Sewerage Structures

1.3 SUBMITTALS

- A. Materials List and Shop Drawings
 - 1. Materials list of items proposed for the work.
 - 2. Shop drawings for all material prior to ordering materials.
- B. As-Built Drawings
 - 1. As-Built Drawings shall indicate the true measurements and location, horizontal and vertical, of all new sanitary sewer system construction. As-Built Drawings shall include a minimum of three (3) ties to each manhole from fixed permanent objects. As-Built drawings shall also contain any additional information required by the municipality. As-Built Drawings shall be stamped with the seal of a Licensed Land Surveyor.
 - 2. Submit a digital copy in a PDF and DWG format to the Engineer upon completion and acceptance of work prior to obtaining substantial completion certificate.
 - 3. Submit paper and mylar copies as required by the local municipality.

1.4 INSPECTION

- A. The manufacturer/supplier is responsible for the provisions and all test requirements specified in ASTM D3034 for SDR 35 gravity pipe and ASTM D2241 for polyvinyl chloride (PVC) pressure rated sewer pipe. In addition, all PVC pipe may be inspected at the plant for compliance with these specifications by an independent testing laboratory selected and paid by the Owner. The Contractor shall require the manufacturer's cooperation in these inspections.

- B. Inspection of the pipe may also be made after delivery. The pipe shall be subject to rejection at any time on account of failure to meet any of the specification requirements, even though pipe samples may have been accepted as satisfactory at the place of manufacture. Pipe rejected after delivery shall be marked for identification and shall be removed from the site at once.

1.5 COORDINATION WITH THE MUNICIPALITY

- A. All work shall conform to the requirements of the local municipality standard details and specifications and other regulatory authorities having jurisdiction, or this specification, whichever is more stringent. Maintain one copy of each on site.

1.6 DELIVERY, STORAGE & HANDLING

- A. All materials shall be adequately protected from damage during transit. Pipes shall not be dropped.
- B. All pipe and other appurtenances shall be inspected before placement in the work and any found to be defective from any cause, including damage caused by handling, and determined by the Engineer to be unrepairable, shall be replaced at no cost to the Owner.
- C. Storage and handling of pipes and other sewer system appurtenances shall be in accordance with the manufacturer's recommendations, subject to the approval of the Engineer.
- D. Do not store pipe, and fittings in direct sunlight.

PART 2 - PRODUCTS

2.1 GENERAL

- A. All materials for the sanitary sewer system shall be new and unused.

2.2 POLYVINYLCHLORIDE PIPE (PVC)

- A. Pipe and Fittings:

1. Polyvinyl chloride pipe and fittings (4 inches to 15 inches) shall be Type PSM polyvinyl chloride (PVC) SDR 35 with full diameter dimensions conforming to the specifications for Type PSM Polyvinyl Chloride (PVC) Sewer Pipe and Fittings, ASTM Designation D3034.
2. Polyvinyl chloride pipe and fittings (18 inches to 27 inches) shall be Type PSM polyvinyl chloride (PVC) SDR 35 with full diameter dimensions conforming to the specifications for Type PSM Polyvinyl Chloride (PVC) Sewer Pipe and Fittings, ASTM Designation F679.

- B. Joints: PVC pipe shall have an integral wall bell and spigot push-on joint with elastomeric gaskets secured in place in the bell of the pipe. The bell shall consist of an integral wall section with a solid cross section elastomeric gasket, factory assembled, securely locked in place to prevent displacement during assembly. Elastomeric gaskets shall conform to ASTM D3212 and ASTM F477.

- C. Spigot pipe ends shall be supplied with bevels from the manufacturer to ensure proper insertion. Each spigot end shall have an "assembly stripe" imprinted thereon to which the bell end of the mated pipe will extend upon proper joining of the two pipes.

2.3 DUCTILE IRON PIPE (GRAVITY)

- A. Ductile Iron Pipe: ASTM A746, Extra Heavy type, bell and spigot end, with epoxy lining per manufacturer's recommendation.
- B. Ductile Iron Pipe Joint: ANSI A21.11, rubber gasket joint.

2.4 CAST IRON PIPE

- A. Cast Iron Soil Pipe: ANSI/ASTM A74, Extra Heavy type, bell and spigot end, inside to be asphalt coated per manufacturer standard.
- B. Cast Iron Pipe Joint: ASTM C564, rubber gasket joint devices.

2.5 CONCRETE PIPE

- A. Concrete Pipe: ANSI/ASTM C14, Class 1, 2 or 3 un-reinforced, bell and spigot end joints.
- B. Concrete Pipe Joint: ANSI/ASTM C443, rubber compression gasket joint.

2.6 REINFORCED CONCRETE PIPE

- A. Reinforced Concrete Pipe: ANSI/ASTM C76, Class V, with wall type B; mesh reinforcement; bell and spigot end joints.
- B. Reinforced Concrete Pipe Joint: ANSI/ASTM C443 rubber compression gasket joint.

2.7 CLEANOUTS

- A. Cleanouts shall be provided on sanitary sewer service laterals. Exterior cleanout plug shall be level with adjacent grade and provided with a concrete apron as shown on the Drawings.

1. Cast-Iron:

- i. ASME A112.36.2M, round, gray-iron housing with clamping device and round, secured, scoriated, gray-iron cover. Include gray-iron ferrule with inside calk or spigot connection and countersunk, tapered-thread, brass closure plug.
- ii. Heavy Duty, H20 Loading
- iii. ASTM A74, Service class, cast-iron soil pipe and fittings.

2. PVC:

- i. PVC body with PVC threaded plug. Include PVC sewer pipe fitting and riser to cleanout of same material as sewer piping.

ii. Heavy Duty, H2O Loading

PART 3 - EXECUTION

3.1 EXCAVATION AND BACKFILLING

The type of materials to be used in bedding and backfilling and the method of placement shall conform to the requirements of Section 312300 – Excavation and Fill, and the details shown on the Drawings.

3.2 PIPE INSTALLATION

- A. All sewer pipe shall be laid accurately to the lines and grades shown in the Drawings and in conformance with pipe manufacturer's recommended procedures.
- B. Installation shall follow ASTM D2321 – Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications
- C. Notch under pipe bells and joints, where applicable, to provide for uniform bearing under entire length of pipe.
- D. Laying Pipe: Each length of pipe shall be laid with firm, full and even bearing throughout its entire length, in a prepared trench. Pipe shall be laid with bells upgrade unless otherwise approved by the Engineer. Do not permanently support pipes on bells.
- E. Every length of pipe shall be inspected and cleaned of all dirt and debris before being laid. The interior of the pipe and the jointing seal shall be free from sand, dirt and trash. Extreme care shall be taken to keep the bells of the pipe free from dirt and rocks so that joints may be properly lubricated and assembled. No pipe shall be trimmed or chipped to fit.
- F. No length of pipe shall be laid until the proceeding lengths of pipe have been thoroughly embedded in place, to prevent movement or disturbance of the pipe alignment.
- G. All piping shall be laid in the dry with the spigot ends pointing in the direction of flow. Installation shall proceed from the downstream to upstream in all cases.
- H. Pipe Extension: Where an existing pipe is to be extended, the same type of pipe shall be used, unless otherwise approved by the Engineer.
- I. Full Lengths of Pipe: Only full lengths of pipe shall be used in the installation except that partial lengths of pipe may be used at the entrance to structures, and to accommodate the required locations of service connection fittings.
- J. Pipe Entrances to Structures: All pipe entering structures shall be cut flush with the inside face of the structure, and the cut ends of the pipe surface within the structure shall be properly rounded and finished so that there will be no protrusion, ragged edges or imperfections that will impede or affect the hydraulic characteristics of the sewage flow. The method of cutting and finishing shall be subject to the approval of the Engineer.
- K. Protection During Construction: The Contractor shall protect the installation at all times during construction, and movement of construction equipment, vehicles and loads over and adjacent to any pipe shall be performed at the Contractor's risk.

- L. At all times when pipe laying is not in progress, all open ends of pipes shall be closed by approved temporary water-tight plugs. If water is in the trench when work is resumed, the plug shall not be removed until the trench has been dewatered and all danger of water entering the pipe eliminated.
- M. Water Pipe - Sewer Pipe Separation: When a sewer pipe crosses above or below a water pipe, the following procedures shall be utilized. The Contractor shall comply with these following procedures:

- 1. Relation to Water Mains

Horizontal Separation: Whenever possible sewers shall be laid at a minimum at least 10 feet, horizontally, from any existing or proposed water main. Should local conditions prevent a lateral separation of 10 feet, a sewer may be laid closer than 10 feet to a water main if:

- i. It is laid in a separate trench, or if
- ii. It is laid in the same trench with the water mains located at one side on a bench of undistributed earth, and if

In either case the elevation of the top (crown) of the sewer is at least 18 inches below the bottom (invert) of the water main.

Vertical Separation: Whenever sewers must cross under water mains, the sewer shall be laid at such an elevation that the top of the sewer is at least 18 inches below the bottom of the water main. When the elevation of the sewer cannot be varied to meet the above requirements, the water main shall be relocated to provide this separation or reconstructed with mechanical-joint pipe for a distance of 10 feet 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.

When it is impossible to obtain horizontal and/or vertical separation as stipulated above, both the water main and sewer shall be constructed of mechanical-joint cement lined ductile iron pipe or other equivalent based on water tightness and structural soundness. Both pipes shall be pressure tested by an approved method to assure water tightness or both pipes shall be encased in concrete.

- 2. Sewer Pipes – Laser Installation: Sewer pipes shall be laid to required grades by use of a laser and target system, unless otherwise specifically approved in writing by engineer.

3.3 PIPE JOINTS

- A. All joints shall be made water-tight.
- B. Pipe shall be jointed in strict accordance with the Pipe manufacturer's instruction. Jointing of all pipe shall be done entirely in the trench.

July 11, 2018

- C. Lubricant for jointing of PVC pipe shall be applied as specified by the pipe manufacturer. Use only lubricant supplied by the pipe manufacturer.
- D. PVC Pipe shall be pushed home by hand or with the use of bar and block. The use of power equipment, such as a backhoe bucket, shall only be used at the direction of the manufacturer.
- E. Field-cut pipe ends shall be cut square and the pipe surface beveled to the size and shape of a factory-finished beveled end. All sharp edges shall be rounded off.
- F. Jointing of Ductile Iron and Cast Iron Pipe shall be in accordance with Section 331000 – Water Distribution Piping.

3.4 CONNECTIONS TO EXISTING UTILITIES

- A. General Requirements: The Contractor shall make all required connections of the proposed sewer into existing sewer system, where and as shown on the Drawings and as required by the Engineer.
- B. Contractor to verify the location, size, invert and type of existing pipes at all points of connection prior to ordering new utility materials.
- C. Compliance with Requirements of Owner of Facility: Connections into existing sewer facilities shall be performed in accordance with the requirements of the Owner of the facility. The Contractor shall comply with all such requirements, including securing of all required permits, and paying the costs thereof. The costs of making the connections in accordance with the requirements of the owner of the existing facility shall be included in the Contract Sum.

3.5 SERVICE CONNECTIONS

- A. General Requirements: The Contractor shall make all required connections of the building sewer service pipes into the sewer system. Work shall include making the service pipe connections into the sewer system pipes or into the manholes located ten (10) feet outside of the proposed building lines. If stubs are constructed for later connection to the building pipes, the ends shall be sealed with watertight plugs.
- B. Coordination with Building Contractor: The Contractor shall coordinate the work with the work of the Building Contractor to determine the exact location and elevation of the point of entry into the building.
- C. Connection into Sewer System: Sewer service pipe connections to the pipe of the sewer system shall be made with fittings supplied by the pipe manufacturer.

The Contractor shall install 45 degree wye branch or 90 degree tee fittings in the sewer pipes at all locations where building sewer service pipe connections are shown on the Drawings. Connections of the sewer service pipes shall be made into the wye branches or tees by means of 45 degree bends. The connections shall be made thoroughly watertight and concrete shall be placed under each connection to bear on undisturbed earth and firmly support the connection. Sewer chimneys shall be encased in concrete unless directed otherwise by the Engineer.

3.6 LEAKAGE TESTS

- A. General Requirements: The Contractor shall test the completed sewer system, including manholes and service connections, for leakage by infiltration, exfiltration or low-pressure air exfiltration tests. Manhole structures may be tested by a low pressure air vacuum test. The tests shall be conducted as approved by the Engineer. The Contractor shall furnish all necessary equipment, materials and labor for performing the tests.

The Contractor shall notify the Engineer at least 48 hours prior to the start of testing. Testing shall only be performed in the presence of the Engineer.

Sections of pipe tested for infiltration and exfiltration prior to completion of the Contract shall be subject to additional leakage tests, if warranted, in the opinion of the Engineer, prior to acceptance of the Work.

- B. Infiltration and Exfiltration Testing: The test length intervals for either type of leakage test shall be approved by the Engineer, but in no event shall they exceed one thousand feet. Where sewer pipe is laid on steep grades, the length to be tested by exfiltration at any one time shall be limited by the maximum allowable internal pressure on the pipe and joints at the lower end of the line. The maximum internal pressure at the lowest end shall not exceed 25 feet of water or 10.8 psi.

The test period, wherein the measurements are taken, shall not be less than four hours in either type of test.

Depending on field conditions, the following tests for leakage shall be employed:

1. Infiltration Test: The test may be used only when ground water levels are at least five feet above the top of the pipe for the entire length of the section to be tested during the entire period of the test. Ground water levels may be measured in an open trench or in standpipes previously placed in backfilled trenches during the backfilling operations. When standpipes are installed in the backfill for ground water measurement, the lower ends shall be satisfactorily embedded in a mass of crushed stone or gravel to maintain free percolation and drainage. Infiltration through joints shall be measured by using a watertight weir or any other approved device for volumetric measurement installed at the lower end of the section under test.
2. Exfiltration Test: This test consists of filling the pipe with water to provide a head of at least five feet above the top of the pipe or five feet above ground water, whichever is higher, at the highest point of the pipe section under test, and then measuring the loss of water from the line by the amount which must be added to maintain the original level. In this test, the pipe must remain filled with water for at least twenty-four hours prior to the taking of measurements. Exfiltration shall be measured by the drop of water level in a closed-end standpipe or in one of the sewer manholes available for convenient measuring.

When a standpipe and plug arrangement is used in the upper manhole of a section under test, a positive method of releasing entrapped air in the sewer shall be installed prior to taking measurements.

3. Leakage Requirements: The total leakage of any section tested shall not exceed the rate of 50 gallons per day per mile per inch of nominal pipe diameter. For purposes of determining the maximum allowable leakage, manholes shall be considered as

sections of 48-inch diameter pipe, five feet long, and the equivalent leakage allowance shall be 2.25 gallons per manhole per 24 hours.

C. Low-Pressure Air Exfiltration Testing

1. The sewer pipes and service pipes shall be tested for leakage by the use of low-pressure air as approved by the Engineer. The test length shall not exceed one length of pipe between two manholes. Air test procedures may be dangerous and the Contractor shall take all necessary precautions to prevent blowouts.
 - i. Pneumatic plugs shall have a sealing length equal to or greater than the diameter of the pipe to be tested.
 - ii. Pneumatic plugs shall resist internal test pressures without requiring external bracing or blocking.
 - iii. All air used shall pass through a single control panel.
 - iv. Three individual hoses shall be used for the following connections:
 - a) From control panel to pneumatic plugs for inflation;
 - b) From control panel to sealed line for introducing the low pressure air;
 - c) From sealed line to control panel for continually monitoring the air pressure rise in the sealed line.
2. The following testing procedures shall be explicitly followed:
 - i. All pneumatic plugs shall be seal tested before being used in the actual test installation. One length of pipe shall be laid on the ground and sealed at both ends with the pneumatic plugs to be checked. Air shall be introduced into the plugs to 25 psig. The sealed pipe shall be pressurized to 5 psig. The plugs shall hold against this pressure without bracing and without movement of the plugs out of the pipe.
3. After the pipe has been backfilled and cleaned, pneumatic plugs shall be placed in the line at each manhole and inflated to 25 psi. Low-pressure air shall be introduced into this sealed line until the internal air pressure reaches 4 psi greater than the average back pressure of any ground water that may be over the pipe. At least two minutes shall be allowed for the air pressure to stabilize.

After the stabilization period (3.5 psi minimum pressure in the pipe), the portion of pipe tested shall be acceptable if the time required in minutes for the pressure to decrease from 3.5 to 3.0 psi (greater than the average back pressure of any ground water that may be over the pipe) is not less than the time indicated in the following table:

<u>Pipe Size (in.)</u>	<u>Time (min.) *</u>
4	0.190L
6	0.427L
8	0.760L
10	1.187L
12	1.709L
15	2.671L

* L = Length of pipe being tested

- D. Vacuum Testing of Manholes: New sewer manholes shall be vacuum tested in accordance with procedure and standards in ASTM C1244.
- E. Correction of Defective Work: If leakage exceeds the specified amount, the Contractor shall make the necessary repairs or replacements required to permanently reduce the leakage to within the specified limit, and the tests shall be repeated until the leakage requirement is met.
- F. Compliance with Agency Requirements: In the event of conflict between the leakage test requirements specified herein with the leakage test requirements of agencies having jurisdiction over all or any portion of the sewer system installed under this Contract, the more restrictive requirements shall govern.

3.7 PIPE DEFLECTION MEASUREMENT

- A. In accordance with ASTM D3034, no less than 30 days after completion of the PVC sewer pipe installation, the Contractor shall test the pipeline for deflection using a “go/no-go” deflection mandrel having a minimum of nine evenly spaced arms or prongs. The “go/no-go” gauge shall be hand pulled through all sections of the pipeline by the Contractor. The Contractor shall submit drawings of the “go/no-go” gauge to the Engineer for approval prior to testing. Complete dimensions of the gauge for each diameter of pipe to be tested shall be in accordance with ASTM D3034.
- B. Any section of pipe found to exceed 7.5 percent deflection shall be deemed a failed pipe and shall be excavated and replaced by the Contractor at his own expense.

3.8 CLEANOUTS

- A. Install cleanouts and riser extensions from sewer pipes to cleanouts at grade. Use cast-iron soil pipe fittings in sewer pipes at branches for cleanouts, and use cast-iron soil pipe for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.
 1. Use Heavy-Duty, top-loading classification cleanouts in vehicle-traffic and truck service areas.
 2. Set cleanout frames and covers in cast-in-place concrete collar as shown on the Drawings. Set with tops flush with surrounding grade.

July 11, 2018

POPE'S TAVERN
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Halifax, Massachusetts

3. Set cleanout frames and covers in concrete pavement and roads with tops flush with pavement surface.

END OF SECTION

Section 33 41 00
STORMWATER DRAINAGE SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and Division 1 Specification Sections apply to work of this section.

1.2 DESCRIPTION OF WORK

- A. Furnish all labor, equipment, and materials necessary to complete the installation of the storm drainage systems as shown on the drawings and by requirements of this section.

1.3 QUALITY ASSURANCE

- A. Installer's Qualifications: Firm with at least 5 years of successful installation experience on projects with storm drainage work similar to that required for project.

1.4 SUBMITTALS

- A. Product Data: Submit manufacturer's product data and installation instructions for each material and product used.
- B. Shop Drawings: Submit shop drawings indicating material characteristics, details of construction, connections, and relationship with adjacent construction.
- C. Record Drawings: At project closeout, submit record drawings of installed storm drainage piping and products.

PART 2 - PRODUCTS

2.1 IDENTIFICATION

- A. Underground-Type Plastic Line Marker: Manufacturer's standard permanent, bright-colored, continuous-printed plastic tape, intended for direct-burial service; not less than 6" wide x 4 mils thick. Provide green tape with black printing reading "CAUTION DRAINAGE LINE BURIED BELOW".

- 1. Manufacturer: Subject to compliance with requirements, provide identification markers of one of the following, or equal:
 - a. Allen Systems Inc.
 - b. Emed Co., Inc.
 - c. Seton Name Plate Corp.

2.2 PIPES AND PIPE FITTINGS

- A. High Density Corrugated Polyethylene Smooth Interior Pipe: ASTM D3350, AASHTO M294, AASHTO M252.

- 1. Fittings: HDPE, AASHTO M252 or AASHTO M294.

2. Coupling bands shall cover at least one full corrugation on each section of pipe. When gasketed coupling bands are required, the gasket shall be made of closed-cell synthetic expanded rubber meeting the requirements of ASTM D1056, Grade RE2. All gaskets shall be installed on the coupler by the pipe manufacturer prior to delivery to the job site all coupling bands shall meet or exceed the soil-tightness requirements of the AASHTO Standard Specifications for Highway Bridges, Section 23, paragraph 23.3.1.5.4 (e). Fittings shall conform to the requirements of AASHTO M294.

B. Schedule 40 PVC Pipe and Fittings: ASTM D2665, Solvent-welded fittings

2.3 DRAINAGE MANHOLES (DMHs)

A. General: Provide precast reinforced concrete drainage manholes as indicated.

1. Basin: Precast reinforced concrete, 48" inside diameter, with flat slab top, base riser section with integral floor.
2. Frame and Cover: Ductile-iron, 26" diameter cover, heavy-duty, indented top design, with lettering cast into top reading "DRAIN", as indicated on the drawings.
3. Pipe Connectors: Resilient, complying with ASTM C 923.
4. Risers: Precast concrete with mortared joints

2.4 LEACHING RECHARGE BASIN (LRB)

A. General: heavy-duty, arch-shaped, interconnecting plastic leaching basins. Height = 18.5 inches; Base Width = 33 inches

B. See drawings for layout

PART 3 - EXECUTION

3.1 INSTALLATION OF IDENTIFICATION

A. General: During back-filling of storm drainage systems, install continuous underground-type plastic line marker, located directly over buried line at 24" above top of pipe.

3.2 INSTALLATION OF PIPE AND PIPE FITTINGS

A. General: Install pipes in accordance with governing authorities having jurisdiction, except where more stringent requirements are indicated.

1. Inspect pipe before installation to detect apparent defects. Mark defective materials with white paint and promptly remove from site.
2. Lay pipe beginning at low point of system, true to grades and alignment indicated, with unbroken continuity of invert.
3. Place bell ends or groove ends of pipe facing upstream.
4. Install gaskets in accordance with manufacturer's recommendations for use of lubricants, cements, and other special installation requirements.
5. Install pipe in accordance with manufacturer's installation recommendations unless otherwise directed by the ENGINEER.
6. Cleaning Pipe: Clear interior of piping of dirt and other superfluous material as work progresses. Maintain swab or drag in line and pull past each joint as it is completed.
 - a. In large, accessible pipe, brushes and brooms may be used for cleaning.
 - b. Place plugs in ends of uncompleted conduit at end of day or whenever work stops.
 - c. Flush lines between manholes if required to remove collected debris.

7. Joint Adapters: Make joints between different types of pipe with standard manufactured adapters and fittings intended for that purpose.
8. Closing Abandoned Utilities: Close open ends of abandoned underground utilities which are indicated to remain in place. Provide sufficiently strong closures to withstand hydro-static or earth pressure which may result after ends of abandoned utilities have been closed.
 - a. Close open ends of concrete or masonry utilities with not less than 8" thick brick masonry bulkheads.
9. Interior Inspection: Inspect pipe to determine whether line displacement or other damage has occurred.
 - a. Make inspections after lines between structures have been installed and approximately 2' of backfill is in place, and again at completion of project.
 - b. If inspection indicates poor alignment, debris, displaced pipe, infiltration or other defects, correct such defects, and reinspect.

3.3 PRECAST CONCRETE DRAIN MANHOLES

- A. General: Place precast concrete sections as indicated. Set tops of frames and covers flush with finish surface
- B. Install in accordance with ASTM C 891.
- C. Provide rubber joint gasket complying with ASTM C 443 at joints of sections.
- D. Apply bituminous mastic coating at joints of sections.

3.4 LEACHING RECHARGE BASINS

- A. Excavate to required depth
- B. Install crushed stone base
- C. Set plastic recharge basin units
- D. Place crushed stone around and between recharge basin units
- E. Connect inlet pipes

3.5 BACKFILLING

- A. General: Conduct backfill operations of open-cut trenches closely following laying, jointing, and bedding of pipe, and after initial inspection and testing are completed.

3.6 TESTING AND INSPECTION

- A. Provide personnel and equipment necessary, and perform tests required to demonstrate that the work of this Section has been completed in accordance with the specified requirements.

End of Section 33 41 00

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SECTION 334900 – STORM UTILITY DRAINAGE STRUCTURES

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This Section specifies requirements for furnishing and installing the site storm drainage system structures.
- B. The work includes:
 - 1. Site storm drainage system manholes, catch basins, separators (water quality units), underground stormwater detention facilities, headwalls, flared end sections, and sediment control devices.

1.2 RELATED DOCUMENTS

- A. Other specification Sections which directly relate to the work of this Section include:
 - 1. -
 - 2. Section 312300 – Excavation and Fill
 - 3. Section 312500 – Erosion Control
 - 4. Section 334100 – Storm Drainage Utility Drainage Piping

1.3 SUBMITTALS

- A. Shop drawings
 - 1. Materials list of items proposed for the work.
 - 2. Shop drawings or descriptive literature, or both, showing dimensions, joint and other details of all materials proposed for the work. Shop drawings shall be submitted to the Engineer for approval prior to ordering material.
- B. As-Built Drawings
 - 1. As-Built Drawings shall indicate the true measurements and location, horizontal and vertical, of all new storm drainage system construction. As-Built Drawings shall include a minimum of three (3) ties showing the distance to each catch basin and manhole from fixed permanent objects. As-Built drawings shall also contain any additional information required by the municipality. As-Built Drawings shall be stamped with the seal of a Licensed Land Surveyor.
 - 2. Submit a digital copy in a PDF and DWG format to the Engineer upon completion and acceptance of work prior to obtaining substantial completion certificate.
 - 3. Submit paper and mylar copies as required by the local municipality.

1.4 COORDINATION AND VERIFICATION

- A. Coordinate the work with the termination of storm drain connections at buildings, connections to municipal systems, and trenching operations.
- B. The contractor shall field verify and survey the size, location and elevations of all existing pipe and utility lines prior to ordering of materials for this utility system. A report of the findings of the verification survey shall be submitted to the engineer for information and comment.

1.5 COORDINATION WITH THE MUNICIPALITY

- A. All work shall conform to the requirements of the local municipality standard details and specifications and other regulatory authorities having jurisdiction, or this specification, whichever is more stringent. Maintain one copy of each on site.

1.6 DELIVERY, STORAGE AND HANDLING

- A. All materials shall be adequately protected from damage during transit. Structures shall not be dropped.
- B. All structures and other appurtenances shall be inspected before placement in the work and any found to be defective from any cause, including damage caused by handling, and determined by the Engineer to be unrepairable, shall be replaced at no cost to the Owner.
- C. Storage and handling of manholes, catch basins, oil-grit separators, treatment units and other system appurtenances shall be in accordance with the manufacturer's recommendations.

1.7 INSPECTION

- A. The manufacturer/supplier is responsible for the provision of all test requirements specified for each type of structure. In addition, any structure may be inspected at the plant for compliance with these specifications by an independent testing laboratory selected and paid by the Owner. The Contractor shall require the manufacturer's cooperation in these inspections.
- B. Inspection of the structures may also be made after delivery. The structure shall be subject to rejection at any time on account of failure to meet any of the specification requirements, even though structure samples may have been accepted as satisfactory at the place of manufacture. Structures rejected after delivery shall be marked for identification and shall be removed from the site at once.

1.8 QUALITY ASSURANCE

- A. Inspection: All components shall be subject to inspection by the Engineer at the place of manufacture and/or installation. All components are subject to be rejected or identified for repair if the quality of materials and manufacturing do not comply with the requirements of this specification. Components which have been identified as defective may be subject for repair. Final acceptance of the component is contingent upon the discretion of the Engineer.
- B. Warranty: The manufacturer shall guarantee the water quality unit components against all manufacturer originated defects in materials or workmanship for a period of twelve (12)

months from the date the components are delivered to the owner for installation. The manufacturer shall be notified of repair/replacement issues in writing within the referenced warranty period. The manufacturer shall, upon its determination of repair, correct or replace any manufacturer originated defects identified by written notice within the referenced warranty period. The use of water quality unit components shall be limited to the application for which it was specifically designed.

- C. Manufacturers of manholes, frames and covers specified in this Section shall have a minimum three (3) years documented experience.

PART 2 - PRODUCTS

2.1 GENERAL

- A. All materials for storm drainage system shall be new and unused.

2.2 STORM DRAIN MANHOLES

A. Precast Units

1. Structure: 48-inch minimum inside diameter, precast concrete units (4,000 psi minimum compressive strength) with eccentric cone section tapering to 24-inch diameter and monolithic base section meeting the requirements of ASTM C478 with gaskets meeting requirements of ASTM C923. All structures shall be designed for HS-20 loading, and shall be sized to accept pipe penetrations as shown on the drawings. Manholes over 12' in depth shall have a minimum inside diameter of five (5) feet.
2. When drop manholes are used the drop shall not be more than 3 ½ feet.
3. Precast Unit Joint Seals: Butyl rubber O-ring type seals meeting the requirements of ASTM C990.
4. Openings for pipe and materials to be embedded in the walls of the manholes sections for joint seals shall be cast in the sections at the required locations during manufacture. Sections with incorrectly cast and patched pipe openings will be rejected.
5. Openings shall be cast into the manhole sections to receive entering pipes during manufacture. The openings shall be sized to provide a uniform 2 inch maximum annular space between the outside of the pipe wall and the opening in the riser. After the pipe is in position, the annular space shall be solidly filled with nonshrink mortar. Care shall be taken to assure that the openings are located to permit setting of the entering pipe at its correct elevation.

B. NOT APPLICABLE

- C. Steps for manholes shall be Steel Reinforced Copolymer Polypropylene plastic step with at least a 14-inch wide stepping surface conforming to ASTM C478 and A615.
- D. Manhole Frame and Cover:
 - 1. Grey iron casting conforming to ASTM A48, heavy duty, with the word "FRAMINGHAM DRAIN" embossed on cover. Letter size shall be three inches. Frame and cover shall be East Jordan Iron Works (formerly LeBaron Foundry Co.) or approved equivalent, with a minimum clear opening of 24 inches and have a minimum eight (8) inches in height.

2.3 CATCH BASINS AND DROP INLET

- A. Precast catch basins and drop inlets shall be manufactured in accordance with ASTM Designation C478 (4,000 psi minimum compressive strength) to the diameters and depths shown on the Drawings. All structures shall be designed for HS-20 loading. Precast unit joints shall be sealed with butyl rubber in accordance with ASTM C990.
- B. Where required for oil and floating debris traps, a slot and opening shall be cast in the catch basin wall for mounting a cast iron trap over the outlet pipe.
- C. When approved by the Engineer, catch basins and drop inlets may be constructed with brick or concrete block walls and poured reinforced concrete bases as an alternative to precast concrete units.
- D. NOT APPLICABLE
- E. Cast iron frames and grate shall conform to ASTM A48, Class 30. When located in accessible ways, grate openings shall meet the requirements of federal, state, and local regulations adopted under the Americans with Disabilities Act (ADA) and the Massachusetts Architectural Access Board (MAAB) requirements. Grates shall have the following wording cast into to the outside borders: "Dump No Waste" and "Drains to Waterway". Text shall be bold letters, at least one-inch high. Placement may be as per manufacturer.
 - 1. Catch basin grates located at low points shall be 24-inch square grate, East Jordan Iron Works (formerly LeBaron Foundry Co.), LF248-2-4F. Single or dual catch basin grate shall consist of a 24-inch square grate LeBaron Foundry Co. L24SG1-000 or approved equal with an 8-inch heavy duty frame (MassDOT Standard). Frames shall be set upon a full bed of mortar, and mortar shall be brought up alongside of frame to provide a water-tight joint.

2. Catch basin cascade grates shall consist of a 24-inch square grate with an 8-inch heavy duty frame (MassDOT Standard) East Jordan Iron Works (formerly LeBaron Foundry Co.), L24SG18L-000 or a L24SG18R-000 (depending on water flow direction) or approved equal with an 8-inch frame. Frames shall be set upon a full bed of mortar, and mortar shall be brought up alongside of frame to provide a water tight joint. Water flowing from left to right requires a Right-Hand Grate. Water flowing from the right to left requires a Left-Hand Grate.

F. Catch basin oil and floating debris trap shall be Ground Water Resource Inc. Eliminator, Best Management Practices Inc., or equal approved by the DPW.

G. Openings at top of concrete structures where curb inlets are required shall be 24 inches by 27 inches.

H. Landscape (Area) drains shall be ADS manufacturer, "NYOPLAST" In-Line drain with cast ductile iron dome grate.

2.4 GRIT AND OIL SEPARATOR - **NOT USED**

2.5 SUSPENDED SOLIDS SEPARATOR

A. Separation Unit (water quality units)

1. The separation unit shall be a manufactured stormwater treatment unit suitable for installation in a precast concrete structure. Suspended solids separators shall be made of precast concrete sections and shall be of the capacity and dimensions indicated on the Drawings.

2. The manufacturer of the water quality unit shall be one that is regularly engaged in the engineering design and production of systems deployed for the treatment of storm water runoff for at least ten (10) years and which have a history of successful production, acceptable to the Engineer. In accordance with the Drawings, the water quality unit(s) shall be manufactured by Imbrium Systems – Stormceptor ® or approved equal.

B. Precast Unit

1. Precast sections shall be cured by an approved ASTM method and shall not be shipped nor subject to loading until the concrete compressive strength has attained 5,000 psi. Portland cement shall be Type II, ASTM C150.

2. Precast units shall be designed for the following loads and possible combinations thereof:

- i. H-20 loading, manhole riser with frame and cones, plus the weight of soil above and the soil loading due to the depth of the structure below finished grade.
- ii. Weight of precast concrete structure.
- iii. Initial handling and erection loadings.

- C. Precast Unit Joints: Butyl rubber section joint conforming to ASTM C990.
- D. Manhole riser sections, manhole steps, frames and covers shall be as specified in Section 2.02.

2.6 STORMWATER DETENTION/INFILTRATION CHAMBERS

- A. In accordance with the Drawings, the stormwater detention/infiltration chambers shall be manufactured by ADS Pipe – StormTech® or approved equal.
 - 1. Stormwater detention chambers shall meet ASTM F2418-05 and the structural design shall be in accordance with AASHTO LRFD Bridge Design Specifications Section 12.12. The units shall be manufactured of high-density polypropylene with open bottoms and perforated sidewalls. The nominal dimensions of each chamber shall be in accordance with the manufacturer's standard. Each chamber shall interlock with the adjacent chamber by overlapping the first rib. End sections and header pipe shall be provided to connect the units to the site drainage.
 - 2. Chamber rows shall provide continuous, unobstructed internal space with no internal support panels in order to provide ease of access for inspection and maintenance. Include number of chambers, distribution piping, end plates, and other standard components as required for system total capacity.
 - 3. Geotextile fabric shall be located per manufacturer's details and provide sediment capture and maintenance.

2.7 OUTLET CONTROL MANHOLES OR STRUCTURES AND HEADWALLS

- A. Outlet structures shall be made of concrete or precast concrete and shall be of the size, capacity, and dimensions indicated on the Drawings. Precast outlet structures shall be as manufactured by Oldcastle Precast, Inc. or approved equal.
- B. Precast sections shall be cured by an approved ASTM method and shall not be shipped nor subject to loading until the concrete compressive strength has attained 4,000 psi minimum and 28 days after fabrication. Portland cement shall be Type II, ASTM C150.
- C. The precast unit shall be designed for the following loads and possible combinations thereof:
 - 1. H-20 loading, manhole riser with frame and cones, plus the weight of soil above and the soil loading due to the depth of the structure below finished grade.
 - 2. Weight of precast concrete structure.
 - 3. Initial handling and erection loading.
 - 4. Cast in place concrete shall be constructed in accordance with Section 033000 – Site Cast-in-Place Concrete.
- D. Construction joints shall be sealed with a butyl rubber-based sealant.
- E. Manhole riser sections, manhole steps, frames and covers shall be as specified for precast concrete storm drain manholes.

July 11, 2018

- F. Grates and grills for outlet structures, which are not manufactured cast iron standards, shall be hot dip galvanized iron units shop constructed to fit the dimensions indicated on the drawings Safety bars shall be 60 Ksi reinforcing steel.

2.8 SILT SACKS/SEDIMENT CONTROL DEVICES

- A. Install at locations shown on the drawings.
- B. Manufacturer: ACF Environmental, Inc. or approved equal.
- C. Material to be a polypropylene geotextile fabric with strength per ASTM D4884.

PART 3 - EXECUTION

3.1 GENERAL

- A. Contractor to verify the locations and types of existing pipes and structures at all points of connection prior to ordering new utility materials.
- B. All structures shall be laid accurately to the locations and elevations shown on the drawings and in conformance with the structures manufacturer's recommendations.
- C. As soon as the trench is excavated to the normal grade of the bottom of the trench, the Contractor shall immediately place the bedding material in the trench. The structure shall be firmly bedded in the compacted bedding material accurately to the locations and elevations shown on the Drawings.
- D. Excavation, backfilling and compaction shall be as specified in Section 312300 – Excavation and Backfill.
- E. Protection During Construction: The Contractor shall protect the installation at all times during construction, and movement of construction equipment, vehicles and loads over and adjacent to any structure shall be performed at the Contractor's risk.
- F. At all times when structure installation is not in progress, all structure openings shall be closed by approved temporary watertight plugs. If water is in the trench when work is resumed, the plug shall not be removed until the trench has been dewatered and all danger of water entering the structure is eliminated.
- G. Do not install structures where site conditions induce loads exceeding structural capacity of structures.
- H. Inspect precast concrete structures immediately prior to placement in excavation to verify structures are internally clean and free from damage. Remove and replace damaged units.

3.2 MANHOLES, CATCH BASINS, AND DROP INLETS-PRECAST

- A. Manholes Catch Basins and Drop Inlets shall be constructed at the locations and to the lines, grades, dimensions and design shown on Drawings or as required by the Engineer.
- B. Precast concrete Units shall be installed in a manner that ensures watertight construction and all leaks in precast concrete structures shall be sealed. If required, precast concrete structures shall be repaired or replaced to obtain watertight construction.

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- C. Stubs shall be short pieces of pipe cut from the bell ends of the pipe. Stubs shall be plugged with brick masonry unless otherwise directed by the Engineer.
- D. Manhole Inverts shall conform accurately to the size of the adjoining pipes.
1. Manhole inverts shall be constructed of 3,500 psi concrete as shown the Drawings.
 2. Inverts shall be laid out in smooth diameter curves of the longest possible radius to provide uniform flow channels.
 3. Invert shelves shall be graded with a 1-inch drop per 1-foot length sloped from the manhole walls.
- E. Manhole steps shall be accurately positioned and embedded in the concrete when the section is cast. Precast-reinforced concrete manhole sections shall be set vertical and with sections and steps in true alignment.
- F. All holes in sections used for their handling shall be thoroughly plugged with rubber plugs made specifically for this purpose or with mortar. The mortar shall be one part cement to 1-1/2 parts sand, mixed slightly damp to the touch, hammered into the holes until it is dense and an excess of paste appears on the surface, and finished smooth and flush with the adjoining surfaces.
- G. Precast sections shall be level and plumb with approved joint seals. Water shall not be permitted to rise over newly made joints until after inspection and acceptance. All joints shall be watertight.
- H. Openings which have to be cut in the sections in the field shall be carefully made to prevent damage to the riser. Damaged risers will be rejected and shall be replaced at no additional cost to the Owner.
- I. Change-In-Type Structures. Where indicated on the drawings, existing subsurface drain structures shall be converted to the new structure types in the following manner;
1. Catch basins to Manholes
 - i. Fill basin sump with 3000 psi concrete and create new inverts at the elevations and sizes indicated and in accordance with specifications and details for new drain manholes.
 - ii. Provide and adjust to grade new drain manhole frame and cover.
 - iii. Stockpile existing frame and grade per Owner directions.
 2. Manholes to Catch Basins (inlets)
 - i. Where sump is indicated on the drawings, replace existing manhole structure with new precast catch basin structure.
 - ii. Where sump is not indicated on the drawings, replace existing frame and cover with new frame and grate and adjust to grade per these specifications and details for new catch basins.

July 11, 2018

POPE'S TAVERN
ADDITION/RENOVATION
Halifax, Massachusetts

- iii. Stockpile existing manhole frame and cover per Owner's directions.

3.3 NOT APPLICABLE

3.4 NOT APPLICABLE

3.5 MANHOLE STEPS

- A. Steps shall be cast into the precast walls during manufacture.
- B. Steps in brick masonry and concrete units shall be installed as the masonry courses are laid.

3.6 CASTINGS

- A. Cast-iron frames for grates and covers shall be well bedded in cement mortar and accurately set to the proposed grades.
- B. All voids between the bottom flange and the structure shall be completely filled to make a watertight fit. A ring of mortar, at least one-inch thick and pitched to shed water away from the frame shall be placed over and around the outside of the bottom flange. The mortar shall

extend to the outer edge of the masonry all around its circumference and shall be finished smooth. No visible leakage will be permitted.

- C. Structures within the limits of bituminous concrete pavement shall be temporarily set at the elevation of the bottom of the binder course. After the binder course has been compacted, the structures shall be set at their final grade. Backfill necessary around such structures after the binder course has been completed shall be made with 3,500 psi concrete.

3.7 GRIT AND OIL SEPARATOR, AND SUSPENDED SOLIDS SEPARATORS – **NOT USED**

3.8 CLEANING, TESTING AND REPAIR

- A. The Contractor shall clean the entire drainage system of all debris and obstructions. This shall include, removal of all formwork from structures, concrete and mortar droppings, construction debris and dirt. The system shall be thoroughly flushed clean and the Contractor shall furnish all necessary hose, pumps, pipe and other equipment that may be required for this purpose. No debris shall be flushed into existing drains, storm recharge chambers, storm drains and/or streams.
- B. Testing and Correction of Defective Work: If a mandrel 3 feet long and 90 percent of the pipe diameter cannot be pulled through the completed pipe runs after 7 days of completed trench backfill, the pipe line shall be deemed unacceptable and the pipe lines shall be removed and replaced. The Contractor shall make the necessary repairs or replacements required to permanently provide an open and structurally sound drainage system capable of supporting the anticipated loading from all sources throughout the year.

3.9 FINAL INSPECTION

- A. Upon completion of the work, and before final acceptance by the Engineer, the entire drainage system shall be subjected to a final inspection in the presence of the Engineer. The work shall not be considered as complete until all requirements for line, grade, cleanliness, mandrel tests and other requirements have been met.

END OF SECTION