Volume I

CITY OF FRAMINGHAM
DEPARTMENT OF PUBLIC WORKS

INVITATION FOR BIDS

FOR

EDGELL ROAD WATER PUMPING STATION REPLACEMENT

BID # PW-428

CITY OF FRAMINGHAM
DEPARTMENT OF PUBLIC WORKS
110 WESTERN AVENUE
FRAMINGHAM, MA 01702

COMMONWEALTH OF MASSACHUSETTS
JOSEPH J. D'ALESIO
SANITARY
No. 33111
REGISTERED
PROFESSIONAL ENGINEER

11/28/20

BETA
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CITY OF FRAMINGHAM
DEPARTMENT OF PUBLIC WORKS
FRAMINGHAM, MASSACHUSETTS 01702

"Dedicated to Excellence in Public Service"

PETER A. SELLERS
EXECUTIVE DIRECTOR | FDPW
BLAKE D. LUKIS
DEPUTY DIRECTOR | FDPW
WILLIAM R. SEDEWITZ - PE
CHIEF ENGINEER | FDPW
DIANE M. CONNER
ASSISTANT DIRECTOR | FDPW

BID NUMBER: PW-428 Edgell Road Pump Station Replacement
DATE: March 6, 2020
TO: Plan Holders
FROM: Ann O'Regan
SUBJECT: Addendum **Two (2)**
BID OPENING TIME: **Thursday, March 12, 2020 at 1:00 P.M.** **(NO CHANGE)**

With reference to Invitation to Bid PW-428, please note the following information contained in this addendum:

A. Notes regarding removal of Saxonville Pump Station Roof from bid (deletion of documents and references).

B. Questions and Answers a provided on pages 2-5 of this addendum.

C. With reference to Bid PW-428, please refer to the following attached documents:

1. Attachment 1 – Pre-Bid Conference Minutes and Sign-In Sheet
2. Attachment 2 – Contract Drawings A-02, A-06, A-10, A-11
3. Attachment 3 – Contract Specification 06402, Interior Architectural Woodwork
4. Attachment 4 – Contract Specification 09900, Painting and Coating
5. Attachment 5 – Massachusetts Water Resources Authority (MWRA) 8(m) Permit #2430

D. All PW-428 bids must be provided on the PW-428 Addendum One Price Sheet. The Addendum One Price Sheet is also attached to this addendum.

Please sign and ***include this sheet with your bid submission*** to signify receipt of this Addendum.

By my signature below, I acknowledge receipt of the following Addenda to this proposal:

Dated ___/___/___

Signature: _____ Date: _____

A. With reference to Invitation to Bid PW-428, please note the following information contained in this addendum:

All work associated with the Saxonville Pump Station Roof Replacement has been deleted from the project. Accordingly, delete:

- Contract Drawing A-12
- References to Saxonville Pump Station Roof Replacement in Specification Section A: Information for Bidders
- Appendix C
- References to Saxonville Pump Station Roof Replacement in Specification Section 01010.1.02.A.
- Specification Section 01025, Bid Item 3
- Specification Section 02082.1.8.C, Results of Testing for Asbestos Table
- Specification Section 07545.3.2.B.

B. With reference to Invitation to Bid PW-428, please note the following questions and answers contained in this addendum:

Question 1: In Sections 17300 & 17320 there are numerous references to:
"Work specifically required under this Section and Section 17320 includes all Instrumentation/Controls work shown on or required by Contract Drawings IC-1 thru IC3, I-001, and I-101 thru I-110."
In the bidding plans I am only seeing I-1, I-2, and I-3 in the Instrumentation Set and no IC drawings or I-101 thru I-110.
Are other Instrumentation Drawings that we should be considering and that can be provided for the bidding process in addition to I-1, I-2, & I-3 that are provided in the Instrumentation Set packet?

Answer to Question 1:

Refer to Appendix E of the Contract Specifications for I-101 thru I-110.

Question 2: We respectively request that the bid opening be re-scheduled to the week of March 16th. Most of our key staff and several of our sub-contractors will be attending the national convention for the Association of General Contractors all of next week, therefore it be in our best interest if this bid could be extended accordingly. Thanks for your consideration.

Answer to Question 2:

There is No Change to the bid opening date and time.

Question 3: Section 03930 – Concrete Rehabilitation and Section 03940 – Crack Repairs by Epoxy Injection, I was not able to find the location of the work or the quantities we are repairing. If you could please provide more information.

Answer to Question 3:

For bidding purposes, the Contractor shall assume crack repairs are not required.

Question 4: Drawing A-02 shows the ceiling to be Drop GWB Ceiling, Drawing A-05, Section 3 shows the ceiling as ACT and on the finish schedule on A-10, it is listed as PT-1, which is Painting of GWB. Please provide clarification and detail on the ceiling.

Answer to Question 4:

The ceiling is to be ACT. Refer to Contract Specification Section 09510 - Acoustical Ceiling Tiles.

Question 5: Drawing A-02 show the floor in the bathroom to be "New Tile Floor" but the Finish Schedule on A-10 shows the floor as SL-1, please confirm which is correct.

Answer to Question 5:

The floor finish is to be SL-1.

Question 6: On Drawing A-02, Room 105 has a note to install painted plywood on the walls. Please clarify if the plywood is to be on the full height of the walls. Also, please provide thickness of plywood.

Answer to Question 6:

3/4" thick plywood, 3' A.F.F. to 7' A.F.F.

Question 7: It is unclear if the interior walls are to be masonry or GWB. Please clarify and provide detail.

Answer to Question 7:

Furred GWB at WC. Please see updated A-02, A-06 and detail 4/A-11, included with this Addendum.

Question 8: Spec Section 05400 and Drawing S-1, provide information on Cold Form Metal Framing, please advise where this product is being used.

Answer to Question 8:

Furred GWB at WC.

Question 9: Please confirm that the signage schedule on Drawing A-10 is all signage required.

Answer to Question 9:

There are two additional signs. Updated A-10 is included with this Addendum. Refer to A-10, details 2 and 3. The signs are located in Interior Elevation 6/A-6 and in Plan 1/A-02. Also refer to Specification Section 10140.

Question 10: Please provide additional detail for Under Counter Refrigerator is section 11310.

Answer to Question 10:

The undercounter refrigerator shall be GE - Spacemaker 5.6 Cu. Ft. Mini Fridge - Stainless steel, Model: GCE06GSHSB.

Question 11: Please confirm the number and size of Entrance Floor Mats.

Answer to Question 11:

Number: 1 in plan, 1 for Attic Stock.
Size: 4' x 6'

Question 12: In regards to the Bid Package Check List:

a. Addenda – Section A.5, is anything from section A required to be submitted with bid?
b. Affirmative Action & Equal Employment Opportunity – Section B.E, please confirm that this is referring to Exhibit E under Section B and whether it is supposed to be submitted with the bid.

Answers to Questions 12a and 12b:

a. The first page of all addendums issued should be executed and included with the bid package.
b. Yes, page 41, receipt page of Exhibit E, should be executed and returned will all bids.

Question 13: How much piping will need to be dewatered for the bypass Suction connection tie-in, as not all of the existing valves are shown?

Answer to Question 13:

For bidding purposes, the Contractor shall assume the suction pipe will require draining from the MWRA "Concrete Riser/Shaft Structure to the existing gate valve at the entrance to the station.

Question 14: How much piping will need to be dewatered for the bypass Discharge connection tie-in, as not all of the existing valves are shown?

Answer to Question 14:

For bidding purposes, the Contractor shall assume the discharge pipe will require draining from the existing station to a location approximately 600-feet away from the station.

Question 15: It appears the new 4-inch underground sanitary piping is to be installed directly under an existing above ground fuel tank. Is this tank slated to be removed prior to construction or will it remain in place?

Answer to Question 15:

Refer to Contract Drawing H-2 for demolition of existing equipment.

Question 16: Drawing P-3 depicts a 4" sanitary waste line exiting the bathroom under the floor slab and under the footprint of the existing electrical gear. Is this existing piping?

a. If not, are we to figure on removing and replacing this section of floor?
b. If not, it appears the routing will be installed under the new electrical gear, as well. Is this the intention?

Answers to Questions 16a and 16b:

Refer to Contract Drawings M-1, P-2 and P-3 for floor demolition and new piping requirements, underground piping and cleanout is intended to be below wall mounted emergency stop.

Question 17: Drawing M-2, calls out Mechanical Joint sleeve couplings on the 24-inch inlet and outlet piping.

a. Typically MJ couplings are installed for underground buried connections.
b. What type of joint connection and pipe OD should be figured to the plain end section of pipe that will remain after demo?
c. Can a detail of this connection be provided, as the detail provided on Drawing MD-1 is not for a plain end of pipe.

Answers to Questions 17a, 17b and 17c:

For bidding purposes, the Contractor shall assume the connection must be adequately restrained from the interior concrete wall to the adjacent 45-degree fitting.

Question 18: Bid Item 2 – Electric Service Allowance- Does this allowance include the following:

a. R&D of existing Eversource Utility Pole and OH lines depicted on Dwg E-3.
b. Furnishing and installing new pole, transformer and transformer pad.
c. Installing primary duct bank A-A.
d. Installing secondary ductbank B-B.

Answers to Questions 18a, 18b, 18c and 18d:

The allowance is to cover Eversource cost only, refer to specifications 16000, paragraph 1.04.B and drawing E-3 for service work.

Question 19: How will cost associated with the installation of the new fiber optic line within ductbank D-D (between Verizon Pole connection and the new interior equipment rack) be handled?

Answer to Question 19:

Owner will pay for cost of service to provide new communication service to building.

Question 20: As the existing SCADA panel is to be relocated outside at the temporary bypass pump system, how long can the City be out of service with this SCADA panel?

a. Time will be needed to disconnect, re-power and test out panel with temporary bypass pump system.
b. We assume the City would want to test out the new temporary bypass system for a period of time before shutting down the existing PS. How long of a testout period will be required?

Answers to Questions 20a and 20B:

a. For bidding purposes, the Contractor shall assume the SCADA panel can be offline for 8-hours. In addition, the SCADA panel cannot be relocated until successful operation of the temporary bypass system is demonstrated.
b. The bypass system shall operate for three (3) days of automatic operation before any work can begin on the station.

Question 21: Can an allowance be provided for the energy costs associated with operating the bypass pump system, as the flowrates (water demands, fire demands, ECT) are indeterminate during the reconstruction period?

a. If not, can the City provide the energy consumption history.

Answer to Question 21:

a. As specified, the Contractor shall be responsible for the bypass system, including all costs associated with operation. Refer to Specification Section 11280 - Maintaining Existing Flow, for the hydraulic conditions the bypass is required to meet. Energy consumption history is not included as the bypass system is required to be designed to meet the specified hydraulic conditions.

Question 22: Brick – The finish schedule on A-10 calls out Belden Modular Full Range Danish for the (BRK-1) exterior walls. Spec. section 04210.2.1 calls out Belden Modular Colony Red. Please clarify which brick should be used for the exterior veneer.

Answer to Question 22:

Belden Modular Colony Red. Revised in attached Contract Drawing A-10.

Question 23: Sound block – Spec section 04200.2.02.E calls for Sound block acoustical CMU. Please indicate where this material should be installed.

Answer to Question 23:

Delete Specification Section 04200, paragraph 2.02.E.

Question 24: Specification Section 08510, Paragraph 2.03A identifies glazing as 1-1/4" insulated unit which with standard 1/2" spacer is 1-5/16". Inboard lite is noted as 9/16" laminated. Specification Section 08800, Paragraph 2.01.2 identifies window glazing as 1-3/16" insulated unit with standard spacer with inboard lite of 7/16" laminated. Is the inboard lite 7/16" or 9/16" laminated? Is the outboard lite assumed to be tempered per Paragraph 2.01B?

Answer to Question 24:

Inboard lite shall be 9/16” laminated as described in Section 08800 for 1 5/16”. Yes, outboard lite is tempered.

Question 25: Please provide the Plan Holders List.

Answer to Question 25:

The Plan Holders List may be viewed on www.framinghamma.gov/dpwbids

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Attachment 1 – Pre-Bid Conference Minutes and Sign-In Sheet

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Attachment 1
Edgell Road Water Pump Station Replacement
Contract No. PW-428
City of Framingham, MA

Pre-Bid Conference – Meeting Minutes
February 27, 2020

Attendees:
Sign-in list attached

Discussion Items:

- The purpose of the project is to replace the Edgell Road Water Pump Station
  - Existing Station was constructed in 1950
  - The only known improvements to the station occurred in 1990 and 2004. The 1990 improvements included the replacement of pumps 1 and 3 and the installation of surge control valves on pumps 1, 2 and 3.

- Project Limits – Scope of Work
  - Demolition of existing water pump station components including:
    - Pump station building complete (except for the concrete foundation)
    - One (1) 75-hp and two (2) 100-hp centrifugal horizontal, split case water pumps, piping, valves and appurtenances.
    - One (1) 270-hp engine driven centrifugal horizontal, split case water pump, piping, valves and appurtenances.
    - Standby diesel fired engine and appurtenances
    - Exterior diesel fuel storage tank, concrete pad and appurtenances
    - Electric components, including the motor control center, incoming power supply, lighting, switches, and power receptacles
  - Construction of a new water pump station components including:
    - Pump station structure complete
    - Three (3) 100-hp centrifugal vertical, split case water pumps, piping, valves and appurtenances
    - Electrical components, including variable frequency drives, incoming power supply, lighting, switches, and power receptacles
    - Exterior standby engine/generator with integral diesel fuel storage tank, piping, valves and appurtenances
    - Instrumentation and control equipment
    - Remove and replace paving
    - Restoration of all disturbed areas
  - Construction of a temporary water bypass system, including connections to the existing underground supply and discharge piping. The supply connection piping and valves have to meet MWRA requirements. There are specific specifications for MWRA piping and valves.
  - Hazardous Material Abatement
  - All related civil, architectural, structural, heating and ventilation, plumbing, electrical and instrumentation control work, yard piping and site work all as more particularly

indicated, shown or described in the Drawings, Specifications, and other Contract Documents.

- Bid Administration
  - Two (2) original bid forms
  - Bid Bond of 5% of Total Bid Required
  - Bids Due and Opened – Thursday, March 12, 2020 @ 1:00 PM (110 Western Ave.)
  - Questions in writing to the City Capitol Procurement Administrator. Questions may be mailed, faxed to (508) 620-4884, or e-mailed to DPWProcurement@FraminghamMa.gov
    - Close on Tuesday, March 3rd, 2020 (4:00 PM)
  - Refer to Bidder's Checklist (Page 1 of Section D) for required items to be submitted with Bid.
  - Refer to Bidder Prerequisites (Page 3 of Section A)
- Notable Contract Administration Items
  - Prevailing Wage Rates Apply – Included in Contract Documents
  - Project Substantially Complete within 540 calendar days from NTP date
- Permits
  - Portions of the work subject to an Order of Conditions, MWRA and MADEP Permits included in the Appendices
  - Contractor required to obtain all other permits
- Hazardous Materials
  - Hazardous Materials Surveys for the Edgell Road Water Pump Station were completed and provided as Appendix A of the Contract Documents along with laboratory analytical.
    - Asbestos and lead containing materials have been identified

Contractor Questions from Pre-Bid Conference:

- **What is the time required to drain the existing suction and discharge lines during installation of the bypass connections.**
  For bidding purposes, the Contractor shall assume:
  - The suction pipe will require draining from the MWRA "Concrete Riser/Shaft Structure existing gate valve at the entrance to the station.
  - The discharge pipe will require draining from the existing station to a location approximately 600-feet away from the station.

- **What company does the City utilize for the security camera?**
  Refer to the Contract Drawings E-4 and E-5 for the security camera scope of work.

- **Do the stations electrical switches contain mercury?**
  Refer to Appendix A of the Contract Specifications for the "Hazardous Materials Survey".

- **Is the pump station floor tile being removed?**
  Refer to the "Demolition Notes" on Contract Drawing A-01.

- **Is anything in the station scheduled for salvage by the City prior to demolition?**
  For the purposes of bidding, the Contractor shall assume the City will identify items for salvage prior to demolition.

- **How was the original roof constructed?**
  The existing roof is steel framed.

- **What is the storage room used for?**
  The storage room is utilized for storage of miscellaneous item that will be removed prior to construction.

City of Framingham, Massachusetts

IFB # PW-428
Edgell Road Water Pump Station Replacement

Pre-Bid Meeting
February 27, 2020– 1:00PM

ATTENDEE SIGN-IN SHEET

By signing this sign-in sheet the Bidder agrees that any information obtained during this tour shall not be used as the basis for their Bid and is to familiarize the Bidder with the site(s) only. In accordance with the Contract Documents, only questions submitted in writing shall become part of the Contract. Questions must be submitted to the Town in writing as detailed in the Contract Documents.

NAME (print)	NAME (sign)	Company	PHONE	E-Mail
James Dyment		BETA Group, Inc.	401 333-2382	jdyment@beta-inc.com
Casey Lemoine		Riccardi Bros, Inc	508-757-0175	casey@riccardibrosinc.com
Chris Gates		RJV Construction	781-821-1469	cgates@rjvconstruction.com
LARRY HARRIS		LAFLEUR ELECTRIC	508-832-9333	lharris@lafleurelectric.com
TED LAMBERT		JF WHITE	508 980 8934	tlambert@jfwhite.com
Mike Saltmarsh		ELM ELECTRIC	413 348 9301	MSALTMARSH@ELMELEC.com
Jeff Schnuff		Jasco Electric Inc	508 520-2055	jeff.schnuff@verizon.net

City of Framingham, Massachusetts

IFB # PW-428
Edgell Road Water Pump Station Replacement

Pre-Bid Meeting
February 27, 2020– 1:00PM

ATTENDEE SIGN-IN SHEET

By signing this sign-in sheet the Bidder agrees that any information obtained during this tour shall not be used as the basis for their Bid and is to familiarize the Bidder with the site(s) only. In accordance with the Contract Documents, only questions submitted in writing shall become part of the Contract. Questions must be submitted to the Town in writing as detailed in the Contract Documents.

NAME (print)	NAME (sign)	Company	PHONE	E-Mail
Jim Ramos		HART ENGINEERING	401-658-4600	JRAMOS@HARTCOMPANIES.com
Al Borden		Equality Construction	401-215-0173	Al@EqualityConstructionWorks.com
VONNIE REIS		COF	508.532.6021	VMR@FRAMINGHAMMA.GOV
Julie Liu		COF	508-532-6039	jliu@framinghamma.gov
		DPW	508 532 6060	

Attachment 2 – Contract Drawings A-02, A-06, A-10, A-11

Updated drawings inserted into the Plan Set

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Attachment 3 – Contract Specification 06402, Interior Architectural Woodwork

Updated Specification inserted into the Contract

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Attachment 4 – Contract Specification 09900, Painting and Coating

Updated Specification inserted into the Contract

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Attachment 5
Massachusetts Water Resources Authority (MWRA) 8(m) Permit #2430

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MASSACHUSETTS WATER RESOURCES AUTHORITY
Chelsea Facility
2 Griffin Way
Chelsea, Massachusetts 02150

Telephone: (617) 242-6000
Facsimile: (617) 305-5990

Frederick A. Laskey
Executive Director

March 6, 2020

Julie Liu
City of Framingham
110 Western Avenue
Framingham, MA 01702

Re: MWRA 8(m) Permit # 2430

Enclosed, please find an MWRA Water Operations 8(m) Permit. The permit authorizes you to conduct operations within or near an easement or other property that are held in interest by MWRA and provides important information. All of the requirements and conditions of the permit are in effective so **please read the permit upon receiving it**.

Permittee or its designee to provide at least 72-hour prior notice to Guy Foss (508) 424-3661 for Mark-outs and Inspection Services (266 Boston Post Road, Southborough, MA 01772).

If you have any questions pertaining to the permit's terms and conditions or any information set forth in this letter, please contact me at (617) 305-5827.

Sincerely,

R Francesconi

Ralph Francesconi
Project Manager
MWRA Water Operations

MASSACHUSETTS WATER RESOURCES AUTHORITY

PERMIT

8m Permit # 2430

12-Feb-20

City of Framingham
110 Western Avenue
Framingham, MA 01702

Pursuant to Section 8 (m) of Chapter 372 of the Acts of 1984 you are hereby granted permission to use a certain portion of land presently under the jurisdiction and control of the Massachusetts Water Resources Authority for the purpose set forth below.

The land is described as follows:

Metropolitan West Tunnel - Hultman Aqueduct - Edgell Road Pump Station - 663 Edgell Road - Framingham, Massachusetts

You may use the land for the purpose of:

Plans Titled: City of Framingham, MA Dept. of Public Works Edgell Road Water Pump Station Replacement - Contract No. PW 428 - January 2020 - Prepared by BETA Group

Approved as to Form:

Massachusetts Water Resources Authority

Law Division 2/13/2020

Approved

Massachusetts Water Resources Authority

Deputy Chief OO, PP&P

This Permit is subject to the 8(m) Permit Terms and Conditions, and the 8(m) Permit Special Terms and Conditions, if any, attached hereto and made a part hereof. Permittee agrees that it shall be bound by, and shall comply with, said Terms and Conditions.

Permittee: _____ / Julie Liu

Signature Print Name

This permit shall have no effect until such time as the Authority issues the fully executed original of this Permit.

Massachusetts Water Resources Authority

2 Griffin Way

Chelsea, MA 02150

Attn: Water Operations - Permitting Department

MASSACHUSETTS WATER RESOURCES AUTHORITY

8 (m) Permit # 8(m) 20-2430

Date: February 12, 2020

8(m) PERMIT TERMS AND CONDITIONS

1. Permittee's use of the land shall at no time interfere with the Authority's activities or operations on the land. The Authority has the right to review and approve all of the Permittee's work including such plans and specifications, as the Authority deems necessary. Any proposed future work beyond the scope of this permit shall have the prior written approval of the Authority.

2. To the fullest extent permitted by law, the Permittee shall indemnify, defend with counsel acceptable to the Authority, keep and save harmless the Authority and its board members, officers, representatives, contractors, agents, employees, successors, and assigns, in both their individual and official capacities, against all suits, claims, liabilities, damages, losses (including but not limited to loss of use resulting therefrom) and expenses, including but not limited to attorney's fees, caused by, arising out of or resulting from any work or activity under this Permit and/or act, omission, breach or default of the Permittee or of any contractor, subcontractor of vendor of the Permittee or anyone directly or indirectly employed by any of them or anyone for whose acts any of them may be liable, regardless of whether or not it is caused in part by a party indemnified hereunder.

3. The granting of this permit shall in no way interfere with the rights of the Authority to exercise its existing rights in or over the permitted land. Permittee acknowledges that the Authority, within its sole discretion, may enter upon the permitted land at any time in order to carry out inspections, maintenance, repairs, replacements, or other activities.

4. The Authority may revoke this permit at any time. The sale or disposition of the land by its owner will cause this permit to terminate without further notice. Permittee shall give the Authority at least 72 hours notice before commencing the operations as pursuant herein. This permit shall not be assigned or transferred.

5. No blasting, drilling or other activity that could in any way affect the integrity or operability of the Authority's property or use of the Premises shall be permitted without express prior written approval of the Authority.

6. The Permittee shall remove, at its own expense, within six months of the date of written notice from the Authority, any or all conduits and appurtenances installed by the Permittee under this permit if, in the Authority's sole discretion, such removal is necessary for the operation, maintenance or replacement of the Authority's infrastructure.

7. To the fullest extent permitted by law, and in consideration of the issuance of this permit, Permittee hereby releases the Authority and its board members, officers, representatives, contractors, agents, employees, successors, and assigns, in both their individual and official capacities, from all suits, claims, liabilities, damages, losses (including but not limited to loss of use resulting therefrom) and expenses, including but not limited to attorney's fees, caused by, arising out of or resulting from any work or activity under this Permit and/or act, omission, breach or default of the Permittee or of any contractor, subcontractor of vendor of the Permittee or anyone directly or indirectly employed by any of them or anyone for whose acts any of them may be liable, regardless of whether or not it is caused in part by a party indemnified hereunder. This release includes, but is not limited to, all suits, claims, liabilities, damages (including, but not limited to, direct, indirect, and consequential damages, economic loss, and loss of profits) and losses which are attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property, including the loss of use resulting therefrom, together with all attorneys' fees, costs and expenses.

8. The Permittee shall conduct design, construction, and excavation in accordance with all federal, state and local safety regulations, including but not limited to, federal OSHA regulations (29 CFR 1926) and Massachusetts Department of Public Safety regulations (520 CMR 14.00). During construction, Permittee shall take appropriate sheeting and shoring measures to protect the integrity of the Authority's water and/or sewer mains. Permittee shall submit design plans stamped by a professional engineer licensed in Massachusetts to the Authority for approval prior to the start of construction.

9. The Permittee shall adjust any or all Authority frames and covers to grade within the limits of work in accordance with the plans referenced in this permit. The Authority will provide the Permittee with new replacement Authority frames and covers that have been deemed unusable by the Authority.

10. If the Permittee is proposing to take borings and/or place test pits within the permitted area, the Permittee shall mark the proposed boring and test pit locations on the ground using paint and/or stakes and submit engineering documents to the Authority showing the proposed boring and test pit locations. Authority staff will review all boring and test pit locations at the site. Upon written clearance of the proposed boring and test pit locations by Authority staff and subject to Permittee providing the Authority with seventy-two (72) hours prior notice, Permittee may commence work at the site.

    The Permittee shall be responsible for the locations of proposed borings and test pits regardless of any act or omission of the Authority. The Permittee shall be responsible for repairing and/or replacing, at the Authority's election, the Authority's property or infrastructure, which is damaged as a result of the Permittee's, its contractors, agents, representatives, employees, and/or invitees activities pursuant to this permit. The Permittee's obligations under this paragraph shall include payment to the Authority for all costs to repair all such damage caused to the Authority's property.

EXHIBIT A

MWRA WATER OPERATIONS SPECIAL TERMS and CONDITIONS

1. **Permittee or its designee to provide at least 72-hour prior notice to Guy Foss (508) 424-3661 for Mark-outs and Inspection Services (266 Boston Post Road, Southborough, MA 01772).**

2. A minimum **vertical clearance of 18 inches** shall be maintained between the Authority's water mains and other utility crossings unless otherwise noted. However, water/gas and other utility service crossings with a pipe size diameter of 2-inches or less maybe permitted to cross the Authority's pipeline at a reduced clearance subject to MWRA review. (Except for special provisions, i.e. capped or plugged pipes, thrust blocks and or bends which would require a greater clearance separation)

3. **A minimum of three-(3) feet to five-(5) feet horizontal clearance is required between adjacent utilities and the side (spring line) of any MWRA main. (Except for special provisions, i.e. capped or plugged pipes, thrust blocks and or pipe bends which would require a greater clearance separation)**

4. Crossings of MWRA water mains shall be located a minimum horizontal distance of at least four (4) feet from any joints of the Authority's mains.

5. Proposed pipe/utility crossings of the Authority's water mains shall cross at a 90-degree angle to minimize interference.

6. For distances over four (4) feet of the Authority's mains which are to be undermined the method and type of pipe support plan shall be submitted and stamped by a Professional Engineer (P.E.) licensed in Massachusetts for prior approval by the Authority.

7. For distances under four (4) feet of the Authority's mains which are to be undermined, the on-site MWRA inspector shall review and approve the proposed support of the main. Under no circumstances shall the Authority's main be left in an unsupported, undermined position overnight.

8. During construction, appropriate sheeting measures must be taken to protect the integrity of the Authority's water mains. The sheeting design must be reviewed by the Authority prior to the start of the construction. The design shall be stamped by a Professional Engineer, licensed in Massachusetts. The use of a Trench Box is not permitted in this application.

9. Suitable compaction methods shall be employed in restoring the beds of the MWRA's mains backfilling around the MWRA's main shall be placed in maximum 6-inch lifts and compacted by hand vibratory compactors.

10. The MWRA pipeline must be protected at all times during construction. The Authority may require a professional engineer licensed in the State of Massachusetts to submit a construction plan and or **pipeline analysis** that is to be attached to this 8m Permit.

SPECIAL TERMS and CONDITIONS (Cont'd)

11. Screened gravel shall be uniformly graded with maximum size of a particle between 3/8 inch and ¾ inch. Screened gravel shall consist of clean, hard and durable particles free from an excess of soft, elongated and disintegrated pieces or other objectionable material. Crushed rock of suitable size and grading maybe used in place of screened gravel at the option of the MWRA Inspector.

12. For test pit excavations or unearthing of the Authority's water main the Permittee must excavate the last **2-feet, before the top of pipe, by hand** or use a vacuum boring method and backfill with approved material within an easement or roadway area.

13. **The Permittee is responsible to adjust any or all MWRA frames and covers to grade within their limits of work in accordance with the plans referenced in this permit. The Authority will provide the Permittee with new replacement MWRA frames and covers (at no expense to the Permittee) for any existing frames and covers that have been deemed unusable by Authority personnel.**

14. All MWRA manhole openings that were covered during the binder course installation shall be made accessible within 48-hours. MWRA manhole frame and covers shall not be removed for grinding and or pulverizing. Pulverizing is not allowed over MWRA manhole structures.

15. The Permittee will provide a logistics construction schedule in writing, along with emergency contact information whenever MWRA valves (manhole covers) or facilities are covered or obstructed.

16. MWRA Inspection personnel must be on site whenever excavation, construction and hoisting or rigging occurs around an MWRA water main pipeline.

17. No construction equipment including cranes, backhoes or material may be parked, stationed, set up or stored on top of the MWRA's water mains or infrastructure.

18. Replacement (shutdown) of the MWRA's mains shall be coordinated with the Authority. Four-(4) weeks-advanced notice in writing is required for shutdowns.

19. The Permittee or its designee shall contact the Authority three (3) weeks in advance when an MWRA water main valve must be operated. **Only MWRA Personnel Will Operate MWRA Valves.** The Permittee or its designee shall not operate any MWRA valves. MWRA Valve Operations are limited during peak demand periods and may not be available between the dates of **May 15th** and **September 15th** of each calendar year.

20. **The Permittee will be responsible to protect and correct any damage(s) to the Authority's property or pipeline at no cost to the MWRA.**

21. As-built drawings shall be furnished to the Authority upon the completion of permitted work. A Professional Massachusetts Registered Land Surveyor or Engineer shall stamp as-built drawings.

22. MWRA Detail Records "field sketches" shall be updated (with accurate field ties) by the Permittee and shall be furnished to the Authority upon the completion of the permitted work.

SPECIAL TERMS and CONDITIONS (Cont'd)

23. The Permittee shall indemnify and hold harmless the Authority and its successors and assigns from any and all damages and/or claims for damage to the Permittee's conduits, facilities and/or property as a result of the Authority's operation, maintenance, repair, and/or replacement of Authority property, or as a result of the failure of an Authority water pipe.

24. This permit addresses only MWRA-owned and operated infrastructure. The Permittee is required to obtain needed separate approvals from the City, Town and other State Agencies.

25. The permitted work and location of installed facilities and appurtenances shall not deviate from the construction plan that is referenced in this permit. No field changes are allowed without prior review and written approval by the MWRA 8m Permit Project manager. An MWRA on site inspector shall review all field changes and coordinate with the Permittee regarding submitting a change of work plan to the Authority for review and comment. If MWRA field inspection indicates changes undertaken without approval, the Permittee may be issued a cease and desist order and be required to correct/reconstruct any completed work.

26. The Authority may require a construction plan along with an analysis of the MWRA's pipeline (prepared by a professional engineer licensed in the State of Massachusetts). The pipeline analysis shall take into consideration the construction equipment, which would be used over the Authority's pipeline in instances where the existing roadway surface will be completely excavated away removing the protection of the HS-20 surface loading barrier. This Plan and supporting calculations will need to be submitted to the MWRA for review.

27. The Authority requires the submittal of "Cut Sheets and or Shop Drawings" for review of all newly proposed materials that will come under the ownership of the MWRA.

28. Where pipe jacking is required, for work that is in close proximity to the Authority's water mains, submittals prepared by a professional engineer and reviewed by the MWRA are required.

29. Permittee shall not expose the spring line or undermine the MWRA's pipeline. The Permittee or its designee shall cease excavation operations and secure the open trench by backfilling the open trench to secure the MWRA's pipeline whenever the spring line is exposed.

30. The Permittee shall mark the proposed boring and test pit locations on the ground using paint and/or stakes and submit engineering documents to the Authority showing the proposed boring and test pit locations. Authority operations staff will review all boring and test pit locations at the site.

31. Upon written clearance of the proposed boring and test pit locations by Authority operations staff and subject to Permittee providing the Authority with seventy-two (72) hours prior notice, Permittee may commence work at the site.

SPECIAL TERMS and CONDITIONS (Cont'd)

32. The Permittee shall be responsible for the locations of the proposed borings and test pits regardless of any act or omission of the Authority. The Permittee shall be responsible for repairing and/or replacing, at the Authority's election, the Authority's property or infrastructure, which is damaged as a result of the Permittee's, its contractors, agents, representatives, employees, and/or invitees activities pursuant to this permit. The Permittee's obligations under this paragraph shall include payment to the Authority for all costs to repair all such damage caused to the Authority's property.

ADDENDUM ONE PRICE SHEET
THIS PRICE SHEET MUST BE SUBMITTED WITH ALL PW-428 BIDS
Note: This Price Sheet was included in PW-428 Addendum One

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PW-428 EDGELL ROAD WATER PUMP STATION REPLACEMENT

ADDENDUM ONE PRICE SHEET

THIS ADDENDUM ONE PRICE SHEET MUST BE SUBMITTED WITH ALL PW-428 BIDS

Instructions:

(1) Insert Total Price for Each Item

(2) Add all products in the Total Price Column and insert the sum for the Total Estimated Price for Bid Evaluation Purposes

In the event of a discrepancy between a Unit Bid Price and Total Price, the Unit Price shall control.

Item #	Quantity	Unit	Description	(1) Total Price
1	1	Lump Sum	Edgell Road Water Pump Station Replacement	$
2	1	Allowance	Electric Service Allowance	$ 50,000.00

(2) Total Estimated Contract Price for Bid Evaluation Purposes	$

_____

Total Estimated Contract Price for Bid Evaluation Purposes ***in WORDS***

Name of Bidder_____

CITY OF FRAMINGHAM
DEPARTMENT OF PUBLIC WORKS

INVITATION FOR BIDS

IFB # PW-428

EDGELL ROAD WATER PUMP STATION REPLACEMENT

CITY OF FRAMINGHAM
DEPARTMENT OF PUBLIC WORKS
110 WESTERN AVENUE
FRAMINGHAM, MA 01702

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CITY OF FRAMINGHAM
Department of Public Works

Invitation for Bid No. PW-428

for

EDGELL ROAD WATER PUMP STATION REPLACEMENT

SECTION A: INFORMATION FOR BIDDERS

1. Bid Submittal

The City of Framingham ("the City") will be accepting competitive sealed bids for the above titled project as described in Paragraph 17 below until **1:00 P.M. on March 12, 2020**, in the Procurement Office of the Department of Public Works ("DPW") at **110 Western Avenue**, Framingham, MA 01702, at which time they will be publicly opened and read. If City Offices are closed due to inclement weather, the bid opening will be held the next business day that City Offices are open at the same time and location noted above

Bids must be completed in blue or black ink and shall include **two (2) original sets** of documents submitted on the form bound herewith and sealed in an envelope clearly labeled and identified with the above IFB number. Bids shall be submitted in compliance with and shall be governed by the City's Short Form of Agreement for Construction and Specifications included herein. All terms used in this Agreement will have the meanings stated in the Short Form of Agreement for Construction, the General Conditions, and the Supplementary Conditions.

All bids must be properly signed and enclosed in a sealed envelope and **plainly marked on the outside with the bid number and name of the project.** Bids received after the date and time set forth above will be considered **LATE BIDS and WILL NOT BE OPENED**.

2. Pre-Bid Conference

A non-mandatory Pre-Bid Conference will be conducted for the project at 1:00 PM on February 27, 2020. The meeting will be held at the Edgell Road pump station which is located at 663 Edgell Road. The meeting will conclude with a site visit to the Saxonville Pump Station located off Watson Place.

3. Bid Deposit

Each bid shall be accompanied by a Bid Deposit in the form of a bid bond, certified check, treasurer's check, or cashier's check issued by a responsible bank or trust company, in the sum of Five Percent (5%) of the total amount of the bid, payable to the City of Framingham. The Bid Deposit shall be enclosed in a separate sealed envelope, appropriately labeled and enclosed in the envelope containing the bid.

A bid bond, in the form set forth in the Bid Package, shall be issued by a surety company or companies registered to do business in Massachusetts and which is acceptable to the City. Surety companies rated B+ or better by A.M. Best Company or rated A or better by Standard & Poors are normally acceptable. The bid bond shall be signed by a resident agent of the surety company who is licensed as a surety broker in Massachusetts. A bid bond not meeting these requirements may be declared non-responsive and be cause for the City to reject the bid.

All Bid Deposits of bidders, except those of the three lowest responsible and eligible bidders, will be returned within five (5) business days, following the bid opening. Except as provided in the items herein entitled "Failure to Furnish Bonds and Insurance Certificates" and "Certification of Foreign Corporation", the Bid Deposits of the three lowest responsible and eligible bidders will be returned upon the execution of the Contract or, if no award is made, upon the expiration of the time prescribed for making an award.

4. Form, Modification, Withdrawal of Bids

A bidder may correct, modify, or withdraw a bid by written notice received by the City prior to the time and date set for the bid opening. Bid modifications must be submitted in a sealed envelope clearly labeled "Modification No.__." Each modification must be numbered in sequence, and must reference the original IFB.

After the bid opening, a bidder may not change any provision of the bid in a manner prejudicial to the interests of the City or fair competition. Minor informalities will be waived or the bidder will be allowed to correct them. If a mistake and the intended bid are clearly evident on the face of the bid document, the mistake will be corrected to reflect the intended correct bid, and the bidder will be notified in writing; the bidder may not withdraw the bid. A bidder may withdraw a bid if a mistake is clearly evident on the face of the bid document, but the intended correct bid is not similarly evident.

5. Questions by Bidders and Addendum

Questions concerning this invitation for bids must be submitted in writing to the Procurement Administrator, City of Framingham, 110 Western Avenue, Framingham, MA 01702, before 4:00 P.M. on March 3, 2020. Questions may be delivered, mailed, faxed to (508) 620-4884, or e-mailed to DPWProcurement@FraminghamMa.gov. Written responses will be e-mailed or faxed to all bidders on record as having picked up the IFB.

If any changes are made to this IFB, an addendum will be issued. Addenda will be e-mailed or faxed to all bidders on record as having picked up the IFB.

Neither the Procurement Administrator nor any other employee of the City is authorized to give interpretations of any portion of the Contract or to give information as to the requirements of the Contract in addition to that contained in the Contract. Interpretations of the Contract or additional information as to its requirements, where necessary, shall be communicated to bidders by written addendum, which addendum shall be considered part of this Contract.

6. Prevailing Wage

Minimum Wage Rates as determined by the Commissioner of the Department of Workforce Development under the provisions of Massachusetts General Law, Chapter 149, Sections 26 to 27D, as amended, apply to this project. If the Contract duration is longer than one year, the City will obtain an updated wage schedule. Any increase or decrease in minimum wage rates will not affect the Contract Price or the unit price for any Contract items. It is the responsibility of each bidder, before bid opening, to request if necessary any additional information on Minimum Wage Rates for those trades people who may be employed for the proposed work under this Contract. The minimum wage rates to be used for this Contract are shown on the schedules provided in Section C. The Bidder's attention is also directed to Paragraph 6.02.F of the General Conditions.

7. Bidder Prerequisites

Only Bidders who can comply with the following should submit bids as only such Bidders will be considered qualified:

a. The bidder shall have been in the business of providing the product(s) and or service(s) for which it is submitting prices herein, for a period of no less than five (5) consecutive years prior to the bid opening date.

b. The bidder shall have provided such services or goods of the size and scope similar to that described herein to municipal customers within the last two (2) years. Bidder shall include with its bid a list of five (5) references for previous contracts requiring the services or goods of the type described herein, including a brief description of the services or goods provided and contact information. A "Bidder Reference Form" is included for the bidder's convenience in Section D. The City reserves the right to solicit references from customers not listed by bidder.

8. Enclosures

A checklist of bid enclosures is provided in Section D, entitled "Bid Package." This checklist is provided as a working document for the convenience of bidders only. It is the bidder's responsibility to read the IFB fully to confirm that it has enclosed all requirements.

9. Signatures

All Bids shall be signed by a person having legal authority to bind the Bidder to the terms and conditions of the Bid, and the person so signing the Bid shall give the person's own name, business address and title. **Bids not properly signed will be rejected as non-responsive.**

All Bids shall be prepared and signed by hand in ink in the proper places provided on the bid form as follows:

a. If the bidder is an individual, by her/him personally

b. If the bidder is a partnership, by the name of the partnership, followed by the signature of each general partner; and

c. If the bidder is a corporation, by the authorized officer, whose signature must be attested to by the Clerk/Secretary of the corporation and the corporate seal affixed.

10. Reservations

The City reserves the right to reject in whole or in part any and all Bids, , to waive minor deviations, to cancel the IFB at any time prior to award, and/or to advertise for new Bids if funds are not available for the project or if any of those actions are in the best interest of the City.

11. Rejection of Bids

Bids which are incomplete, conditional or obscure, or which contain any additions not called for, or which otherwise do not conform to the requirements of the applicable statutes or to the requirements for submission set forth herein will be rejected as non-responsive. Bids which contain erasures, alterations or irregularities of any kind or which fail to fully meet the requirements for bid submission set forth herein, or which contain abnormally high or abnormally low prices for any item of work may be rejected as non-responsive.

More than one bid from the same bidder, whether or not the same or different names appear on the signature page, will not be considered. Reasonable grounds for believing that any bidder is so interested in more than one bid for the work contemplated may cause rejection of all bids made by that bidder directly or indirectly.

Any or all bids potentially affected by collusion will be rejected if there is reason for believing that collusion exists among the bidders. The decision of the City will be final. Bidders whose bids have been rejected because of evidence of collusion will not be considered in future bids for the same work and may be disqualified from bidding on future work.

The City shall reject any Bid that does not include the signed Non-Collusion and Attestation Forms provided in the Bid Package.

12. Examination of Bid Documents and Site of Work

Before submitting the bid, the Bidder shall become familiar with the Bid Documents that will form parts of the Contract, shall have investigated in detail the locations of work and shall have made such examination thereof as may be necessary to satisfy itself in regard to the character of the work involved and all conditions affecting the work to be done and labor and materials needed, including impact on other City work, and make the Bid in sole reliance thereon. Statements as to the condition under which work is to be performed are made solely to furnish a basis for comparison of Bids, and while the City believes them to be correct, the City does not guarantee their accuracy. The Bidder is responsible for verifying visible and reasonably anticipated conditions.

13. Rule for Award

One Contract will be awarded to the responsive and eligible bidder offering the lowest Total Estimated Contract Price for Bid Evaluation Purposes subject to the reservations contained herein and to the exceptions set forth in MGL Chapter 30 or Chapter 149, whichever is applicable, within ninety (90) calendar days after the bid opening.

The time for award may be extended by mutual agreement between the City and the apparent lowest responsive and responsible Bidder, during which time there will be no increase in the Bid price or Contract period.

The successful bidder will within ten (10) calendar days of the notification of contract award by the City, execute a contract in accordance with the terms and conditions of this bid and furnish insurance certificates, contract bonds, and, if applicable, certification from the state secretary as required herein.

The date Contract Times will commence to run shall be communicated to the successful bidder by the City's written Notice to Proceed.

14. Interpretation of Estimated Quantities

Unless otherwise stated, quantities shown in the Specifications and Price Sheets represent the estimated quantities of labor and materials which might be expected to be encountered during the contract period. In the event of a discrepancy between the estimated quantities shown in the Specifications and those shown in the Price Sheets, quantities shown in the Price Sheets shall control. The City does not expressly or by implication agree that the actual amount of work will correspond therewith. These estimated quantities will be used solely for the comparison of bids.

The City reserves the right to increase, decrease, or delete the amount of any or all items of work after bids have been received. Such increase, decrease or deletion in the quantity for any item shall not be regarded as cause for an increase or decrease in the unit prices.

No allowance will be made for any increased expense, loss of expected reimbursement, or loss of anticipated profits suffered or claimed by the Contractor resulting either directly or indirectly from such increased, decreased, or deleted quantities or from unbalanced allocation among the Contract items or overhead expenses on the part of the bidder and subsequent loss of expected reimbursement therefore or from any other cause.

15. Failure to Furnish Bonds and Insurance Certificates

Should the successful bidder fail to perform its agreement to furnish the required bonds and insurance certificates required herein, the Bid Deposit shall become and be the property of the City as liquidated damages; provided that, the amount of the Bid Deposit which becomes the property of the City shall not, in any event, exceed the difference between its bid price and the bid price of the next lowest responsible and eligible bidder.

15.01 Certification of Foreign Corporation

If the successful bidder is a foreign corporation as defined at G.L. c. 156D, § 1.4, and if successful bidder fails to perform its agreement to furnish the required certificate of the state secretary, the Bid Deposit shall become and be the property of the City as liquidated damages; provided that, the amount of the Bid Deposit which becomes the property of the City shall not, in any event, exceed the difference between its bid price and the bid price of the next lowest responsible and eligible bidder.

16. Massachusetts Sales and Use Tax

Bidders are advised that the City is exempt from Sales and Use Tax and shall submit its bid prices without taxes. An Exemption Certificate may be obtained by the Successful Bidder from the City upon request.

17. Project Description

The work done under this contract consists of furnishing all necessary labor, materials, and equipment to replace the existing Edgell Road Water Pumping Station and the adjacent water distribution system components, replace the Saxonville Pump Station Roof and all incidental items necessary to complete the work shown on the plans and described herein.

18. Health and Safety

This Contract is subject to the Safety and Health Regulations of the U.S. Department of Labor set forth in Title 29 CFR, Part 1926 and to all subsequent amendments, and to the Massachusetts Department of Labor and Industries, Division of Industrial Safety "Rules and Regulations for the Prevention of Accidents in Construction Operations" (Chapter 454 CMR 10.00 et seq.). Bidders shall be familiar with the requirements of these regulations.

19. Monthly Price Adjustment for Diesel Fuel, Gasoline, Asphalt, Concrete, and Steel

Monthly price adjustments will be made for qualifying work orders using Diesel Fuel, Gasoline, Asphalt, Concrete, and Steel in accordance with the Specifications.

20. City Forms

The City will use its standard form Notice to Proceed, Certificate of Substantial Completion, and General Release. Current examples of these forms are attached to this Section as Example 1, 2, and 3.

21. Permits and Approvals

The successful bidder will be solely responsible for obtaining all necessary construction permits, licenses, and approvals required in connection with the Project and/or under the Contract Documents, including without limitation as set forth in Paragraphs 4.01 and 6.08 of the General Conditions. The City has included the following documents as Section 01060 – Regulatory Requirements solely to furnish a basis for comparison of Bids, and the City makes no representation or guarantee of their relevancy. All bidders shall be responsible for investigating in detail the permitting requirements of the work and shall be responsible for making such examination thereof as may be necessary to satisfy themselves in regard to the character of the permitting required, and shall Bid in sole reliance upon their own investigation.

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Example 1 - Notice to Proceed

To: _____ Date: _____
(Contractor)

_____ Agreement: _____
(Insert title of Agreement as it appears in Contract Documents)

_____ _____

_____

You are hereby notified that the Effective Date of the above Agreement is _____; you are to start performing your obligations under the Agreement by that date. The Contract Times shall commence to run on _____; you must commence Work by that date. Before you may start Work, you must satisfy all requirements set forth in Article 2 of the General Conditions.

_____ _____
(Owner) (Engineer)

By: William R. Sedewitz, P.E. By: _____

Title: Chief Engineer Title: _____

Department of Public Works _____

Contractor hereby acknowledges receipt of the above Notice to Proceed, this the _____ day of _____, 20___.

By: _____

Title: _____

Example 2 - Substantial Completion

ENGINEER'S CERTIFICATE OF SUBSTANTIAL COMPLETION

ENGINEER
CONTRACTOR

PROJECT:
(Name and Address)

PROJECT NO.:

CONTRACT FOR:
CONTRACT DATE:

TO OWNER: City of Framingham
Department of Public Works
100 Western Ave., Framingham, MA 01702

TO CONTRACTOR:
(Name and Address)

DATE OF ISSUANCE:
PROJECT OR DESIGNATION PORTION SHALL INCLUDE:

The Work performed under this Contract has been reviewed and found, to the Engineer's best knowledge, information and belief, to be substantially complete. Substantial Completion means that the Work has been completed except for Work having a contract price of less than one percent of the then adjusted total Contract Price, or substantially of the Work has been completed and opened to public use except for minor incomplete or unsatisfactory Work items that do not materially impair the usefulness of the Work. The date of Substantial Completion of the Project or portion thereof designated above is hereby established.

The Owner will send Contractor a list of items to be completed or corrected within 15 days of the date of Substantial Completion and a Substantial Completion Estimate within 65 days of the date of Substantial Completion. The failure to include any items on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents.

ENGINEER/ARCHITECT	BY	DATE

The Owner accepts the Work or designated portion thereof as substantially complete and will assume full possession thereof at _____ (time) on _____ (date).

PROJECT MANAGER	BY	DATE
OWNER	BY	DATE

The responsibilities of the Owner and Contractor for security, maintenance, heat, utilities, damage to the Work and insurance shall be as provided in the Contract Documents, subject to such additional provisions or clarification as follows:

Example 3 - General Release

GENERAL RELEASE

For good and valuable consideration, the receipt and sufficiency of which is hereby acknowledged, _____ (hereinafter the RELEASOR), does hereby remise, release and forever discharge the City of Framingham (hereinafter "RELEASED PARTY"), its principals, agents, trustees, managing members, officers, directors, employees, representatives, affiliates, subsidiaries, parent companies, successors, assigns, insurers, reinsurers, consultants, attorneys, and all other persons, firms, corporations with whom/which said RELEASED PARTY has been, is now or may hereafter be affiliated, and all other persons, firms, entities or corporations who are or can ever, in any way, be liable to them from all debts, demands, actions, causes of action, suits, dues, sum and sums of money, accounts, reckonings, bonds, specialties, covenants, contracts, insurance policies, controversies, agreements, promises, doings, omissions, variances, damages, extents, executions and liabilities and any and all other claims of every kind, nature and description whatsoever, in both LAW and EQUITY, that the RELEASOR now have or ever had, from the beginning of the world to the date of execution herein, whether known or unknown, including but not limited to any and all claims arising out of the project known as the _____ ("Project") in Framingham, Massachusetts, and any and all claims for additional compensation that comprise all Change Orders to the Contract for the Project, and any and all related claims that were asserted or could have been asserted.

RELEASOR further acknowledge that this Release may be offered in evidence by any of the RELEASED PARTY in judicial or other proceedings to enforce any of its provisions against said RELEASOR, their heirs, executors, administrators, assigns, legal representatives, estates and successors or for any other purpose.

It is expressly understood and agreed by the RELEASOR and the RELEASED PARTY that this Release reflects the settlement of a disputed claim and is not to be construed as an admission of liability on the part of said RELEASED PARTY and that said RELEASED PARTY expressly denies any liability for any injury or damage of any kind or nature to _____.

No promise or inducement which is not herein expressed has been made to the RELEASOR in executing this Release. The RELEASOR does not rely upon any statement or representation made or alleged to have been made by or on behalf of any of the RELEASED PARTY or any agent, servant, employee, attorney, insurer or any other person representing the RELEASED PARTY concerning the nature, extent or duration of said damages or losses or the legal liabilities therefore.

The RELEASOR hereby understands and acknowledges that this RELEASE contains the entire agreement between the parties hereto, and the terms of this RELEASE are contractual and not a mere recital.

The RELEASOR hereby represents that it has read and understands the terms of this RELEASE, had the opportunity to consult with an attorney of its choice prior to the execution of this RELEASE, and did in fact consult with such an attorney prior to execution of this RELEASE.

The RELEASOR further represents that the person executing this RELEASE on behalf of the RELEASOR has the requisite authorizations and approvals of the RELEASOR necessary to bind the RELEASOR to the terms hereto.

This RELEASE is and always will be deemed to have been made in the Commonwealth of Massachusetts.

Executed as a sealed instrument this _____day of _____, 20___.

_____

_____
By:
Its: _____ duly authorized
Date: _____, 20___

Commonwealth of Massachusetts

_____, ss. Date:_____

On this _____ day of _____, 20___, before me, the undersigned notary public, personally appeared _____ and proved to me through satisfactory evidence of identification, which was _____, to be the person whose name is signed on the within document, and acknowledged that he/she signed it as his/her free act and deed, in his/her capacity as _____, and on behalf of _____.

_____
Notary Public
My Commission Expires:

SECTION B: SHORT FORM OF AGREEMENT

The awarded bidder will be expected to enter into an Agreement with the City by executing the attached Short Form of Agreement ("Contract".)

This Contract contains terms and conditions which the Bidder agrees to by submission of its bid.

Do ***not*** complete or return this form with the bid.

THE REMAINDER OF THIS PAGE IS LEFT BLANK INTENTIONALLY

SHORT FORM OF AGREEMENT FOR CONSTRUCTION BETWEEN CITY AND CONTRACTOR PROCURED UNDER G.L. C. 30, §39M

THIS AGREEMENT for **Edgell Road Water PumpStation Replacement** (hereinafter referred to as the "Project"), is made the **_____ day of _____, 2020,** by and between_____, a corporation duly organized under the laws of the Commonwealth of Massachusetts, with a usual place of business at_____, (hereinafter referred to as the "CONTRACTOR"), and the City of Framingham, a municipal corporation duly organized under the laws of the Commonwealth of Massachusetts, (hereinafter referred to as the "CITY").

WITNESSETH that the CONTRACTOR and the CITY, for the consideration hereinafter named, agree as follows:

ARTICLE 1: CONTRACT DOCUMENTS

The Contract Documents consist of the following, and in the event of conflicts or discrepancies among them, they shall be interpreted on the basis of the following priorities and in the manner most favorable to the City:

(1) This Short Form of Agreement for Procurement between City and CONTRACTOR
(2) General Conditions of the Construction Contract, as modified by the Supplementary Conditions
(3) Specifications
(4) Invitation for bids, bid specifications, request for proposals or purchase description
(5) Drawings required for the project
(6) Performance bond in the form attached hereto as **Exhibit A**
(7) Payment bond in the form attached hereto as **Exhibit B**
(8) Addenda issued prior to execution of the Agreement
(9) CONTRACTOR's bid or proposal
(10) Modifications issued after execution of the Agreement, which are not attached hereto, including the following:
    a. Work Order issued by the City
    b. Written amendment to the Agreement signed by both parties
    c. Change Order
(11) Copies of all required bonds, certificates of insurance and licenses required under the Agreement,
(12) Notice to Proceed, which may be delivered or issued on or after the Effective Date of this Agreement and may not be attached hereto
(13) The Summary of Conflict of Interest Law for Municipal Employees attached hereto as **Exhibit C**, as well as the acknowledgement of receipt of summary attached hereto as **Exhibit D** and confirmation of completion of online training, and
(14) Affirmative Action & Equal Employment Opportunity Requirements attached hereto as **Exhibit E**

EACH OF WHICH IS ATTACHED HERETO except as otherwise provided. These documents form the entire Agreement between the parties and there are no other agreements between the parties. Any amendment or modification to this Agreement must be in writing and signed by an official with the authority to bind the City. Such amendment or modification shall be incorporated into and made part of this Agreement.

ARTICLE 2: SCOPE OF WORK

The CONTRACTOR shall furnish all materials, labor and equipment, and perform all work shown on the Contract Documents, and the CONTRACTOR agrees to do everything required by this Agreement and the Contract Documents.

ARTICLE 3: TERM OF AGREEMENT

(a) The Agreement shall be for a term **of Six Hundred 600 calendar days** commencing on XXX, 2020 and ending on XXXXX, 2022, subject to annual appropriation as described in Article 7 "Termination". This Agreement may be renewed in writing at the sole option of the CITY, and upon the terms described in writing.

(b) All time limits for Milestones, if any, Substantial Completion, and completion and readiness for final payment as stated in the Contract Documents are of the essence of the Agreement.

(c) The Work will be substantially completed within **Five Hundred and Forty (540) calendar days** after the date when the Contract Times commence to run as provided in Paragraph 2.01 of the General Conditions, and completed and ready for final payment within **Five Hundred and Seventy (570) calendar days** after the date when the Contract Times commence to run.

(d) If the CONTRACTOR fails to substantially or finally complete the work or achieve any Milestone by the date specified in the Contract Documents, or an extended completion date which is mutually agreed upon by the CITY and the CONTRACTOR, the CONTRACTOR shall pay to the CITY not as a penalty but as liquidated damages the sum of $2,200.00 Dollars per day for each and every calendar day beyond the date on which completion was required. This amount is fixed and agreed upon by and between the CITY and CONTRACTOR to be the amount of damages which the CITY would sustain, and is based upon the parties' agreed upon reasonable estimate of those actual damages likely to result from the CONTRACTOR's breach hereunder. The CITY's right to assess liquidated damages shall not preclude the CITY from the exercise of any other rights to recover damages on account of the CONTRACTOR's failure to achieve substantial or final completion within the time required.

ARTICLE 4: THE CONTRACT SUM

1. The CONTRACTOR agrees to provide to the CITY items at the specific price points listed in the CONTRACTOR'S bid submission, for the duration of the contract. The CITY

makes no guarantee to purchase any minimum or specific quantity of goods or services under the provisions of this contract. The total value of the goods and services will not exceed the sum of **$_____** (xxxxxxxxxxxxxxx and no cents) without the issuance of a change order agreed to in writing by all parties.

2. The Unit Prices, if any, approved by the City are those included in the Contractor's bid or proposal.

3. **N/A**

ARTICLE 5: PAYMENT

(a) CONTRACTOR shall submit Applications for Payment in accordance with Paragraph 14.02 of the General Conditions. Applications for Payment will be processed by Engineer as provided in the General Conditions.

(b) Prior to Substantial Completion, progress payments will be made in an amount equal to the percentage indicated below but, in each case, less the aggregate of payments previously made and less such amounts as Engineer may determine or Owner may withhold, including but not limited to liquidated damages, in accordance with Article 3 of this Agreement.

1. 95% of Work completed (with the balance being retainage).

2. 95% percent of cost of materials and equipment not incorporated in the Work but which satisfies the requirements of Paragraph 14.02.A of the General Conditions (with the balance being retainage).

(c) Upon satisfaction of the Substantial Completion procedures sent forth in Paragraph 14.04 of the General Conditions, the City shall pay an amount sufficient to increase total payments to CONTRACTOR to 99% of the Work completed, less such amounts as Engineer may determine or Owner may withhold in accordance with Article 3 of this Agreement and Paragraph 14.04 of the General Conditions.

(d) Upon final completion and acceptance of the Work and satisfaction of the procedures set forth in Paragraph 14.06 of the General Conditions, the City shall pay the remainder of the Contract Price as recommended by Engineer as provided in Paragraph 14.07 of the General Conditions.

ARTICLE 6: CONTRACTOR'S REPRESENTATIONS

In order to induce the City to enter into this Agreement, CONTRACTOR makes the following representations:

A. CONTRACTOR has examined and carefully studied the Contract Documents and the other related data identified in the Bidding Documents.

B. CONTRACTOR has visited the Site and become familiar with and is satisfied as to the general, local, and Site conditions that may affect cost, progress, and performance of the Work.

C. CONTRACTOR is familiar with and is satisfied as to all federal, state, and local Laws and Regulations that may affect cost, progress, and performance of the Work.

D. CONTRACTOR has carefully studied all: (1) reports of explorations and tests of subsurface conditions at or contiguous to the Site and all drawings of physical conditions relating to existing surface or subsurface structures at the Site (except Underground Facilities), if any, that have been identified in the Contract Documents as containing reliable "technical data", and (2) reports and drawings of Hazardous Environmental Conditions, if any, at the Site that have been identified in the Contract Documents as containing reliable "technical data."

E. CONTRACTOR has considered information known to CONTRACTOR; information commonly known to CONTRACTORs doing business in the locality of the Site; information and observations obtained from visits to the Site; the Contract Documents; and the Site-related reports and drawings identified in the Contract Documents, with respect to the effect of such information, observations, and documents on (1) the cost, progress, and performance of the Work; (2) the means, methods, techniques, sequences, and procedures of construction to be employed by CONTRACTOR, including any specific means, methods, techniques, sequences, and procedures of construction expressly required by the Contract Documents; and (3) CONTRACTOR's safety precautions and programs.

F. Based on the information and observations referred to in Paragraphs A through E above, CONTRACTOR does not consider that further examinations, investigations, explorations, tests, studies, or data are necessary for the performance of the Work at the Contract Price, within the Contract Times, and in accordance with the other terms and conditions of the Contract Documents.

G. CONTRACTOR is aware of the general nature of work to be performed by Owner and others at the Site that relates to the Work as indicated in the Contract Documents.

H. CONTRACTOR has given Owner written notice of all conflicts, errors, ambiguities, or discrepancies that CONTRACTOR has discovered in the Contract Documents, and the written resolution thereof by Owner is acceptable to CONTRACTOR.

I. The Contract Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performance and furnishing of the Work.

ARTICLE 7: TERMINATION

In addition to the provisions of Article 15 of the General Conditions, the CITY shall have the right to terminate this Agreement if funds are not appropriated or otherwise made available to support the continuation of this Agreement after the first year.

ARTICLE 8: NOTICE

All notices required to be given under this Agreement shall be in writing and shall be effective upon receipt by hand delivery or by registered or certified mail to:

City of Framingham:
Capital Procurement Administrator
Department of Public Works
Ann O'Regan
110 Western Avenue
Framingham, MA 01702

CONTRACTOR:
Name _____
Title _____
Company _____
Address _____
_____
Phone:_____
Fax:_____
E-Mail:_____

ARTICLE 9: PERFORMANCE AND PAYMENT BONDS

When CONTRACTOR delivers the executed counterparts of the Agreement to Owner, CONTRACTOR shall also deliver performance and payment bonds as follows, subject to the additional requirements set forth in Paragraph 5.01 of the General Conditions:

(a) The CONTRACTOR shall furnish a **100% Performance Bond** from a surety company qualified to do business under the laws of the Commonwealth of Massachusetts which is satisfactory to the CITY in the full amount of the Contract Price and in the form attached hereto as **Exhibit A**.

(b) The CONTRACTOR shall furnish a **100% Payment Bond** from a surety company qualified to do business under the laws of the Commonwealth of Massachusetts which is satisfactory to the CITY in the full amount of the Contract Price and in the form attached hereto as **Exhibit B**.

ARTICLE 10: INSURANCE

A. Insurance Generally.

1. The CONTRACTOR shall purchase and maintain insurance of the type and limits listed in this Article 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 or for such longer period as this Article requires.

2. All policies shall be written on an occurrence basis and be issued by companies lawfully authorized to write that type of insurance under the laws of the Commonwealth with a financial strength rating of A- or better as assigned by AM Best Company, or an equivalent rating assigned by a similar rating agency acceptable to the CITY, or otherwise acceptable to the CITY.

3. CONTRACTOR shall submit three originals of each certificate of insurance, acceptable to the CITY, simultaneously with the execution of this Contract. Certificates shall show each type of insurance, insurance company, policy number, amount of insurance, deductibles and/or self-insured retentions, and policy effective and expiration dates. Certificates shall show the CITY and anyone else the CITY requests as an additional insured as to all policies of liability insurance. Certificates shall specifically note the following:

- that the General Liability policy includes contractual liability
- that the General Liability policy includes the CITY as additional insureds for ongoing operations (CG 20 10) and for completed operations (CG 20 37) or equivalent endorsements.
- that the automobile liability, umbrella liability and pollution liability policies include the CITY as additional insureds
- that the General Liability policy includes endorsement CG 24 04 or equivalent, a Waiver of Subrogation in favor of the CITY
- that the Builders' Risk or Installation Floater is on an all risk basis including earthquake and flood, and includes the CITY, CONTRACTOR, subcontractors and suppliers of any tier as named insureds or loss payees as their interests may appear.
- that the policies have been endorsed such that none of the coverages shall be cancelled, terminated, or materially modified unless and until 30 days prior notice is given in writing to the CITY.

CONTRACTOR shall submit updated certificates prior to the expiration of any of the policies referenced in the certificates so that the CITY shall at all times possess certificates indicating current coverage.

D. If the CITY requests, the CONTRACTOR shall file one certified complete copy of all policies and endorsements with the CITY. If the CITY is damaged by the CONTRACTOR's failure to maintain such insurance and to comply with the terms of this Article, then the CONTRACTOR shall be responsible for all costs and damages to the CITY attributable thereto.

E. Termination, cancellation, or material modification of any insurance required by this Contract, whether by the insurer or the insured, shall not be valid unless written notice thereof is given to the CITY at least thirty days prior to the effective date thereof, which shall be expressed in said notice.

F. The CONTRACTOR is responsible for the payment of any and all deductibles under all of the insurance required below. The CITY shall not in any instance be responsible for the payment of deductibles, self-insured retentions, or any portion thereof.

2. <u>Commercial General Liability.</u>

A. The CONTRACTOR shall purchase and maintain broad form general liability coverage on the ISO form CG 00 01 or equivalent, including products and completed operations, on an occurrence basis. The form must be amended to state that the aggregate limit applies on a per location/project basis. The policy shall provide the following minimum coverage to protect the CONTRACTOR from claims with respect to the operations performed by CONTRACTOR and any employee, subcontractor, or supplier, or by anyone for whose acts they may be liable:

Bodily Injury &	$1,000,000 each occurrence
Property Damage	$2,000,000 general aggregate per project
Products & Completed Operations	$2,000,000 annual aggregate
Personal & Advertising Injury	$1,000,000 each occurrence
Medical Expenses	$10,000

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

C. This policy shall include contractual liability coverage.

D. The completed operations coverage shall be maintained for a period of three (3) years after Substantial Completion and acceptance by the CITY. The CONTRACTOR shall provide renewal certificates of insurance to the CITY as evidence that this coverage is being maintained.

E. If the Work includes work to be performed within 50 feet of a railroad, any exclusion for liability assumed under contract for work within 50 feet of a railroad shall be deleted.

F. This policy shall include the CITY and anyone else requested by the CITY as an additional insured via endorsements CG 20 10 for ongoing operations and CG 20 37 for completed operations This policy shall be primary and non-contributory with respect to any other insurance available to additional insureds.

G. The policy shall include endorsement CG 24 04, a Waiver of Subrogation in favor of the CITY.

3. <u>Automobile Liability.</u>

A. The CONTRACTOR shall purchase and maintain the following minimum coverage with respect to the operations of any owned, non-owned, and hired vehicles including trailers used in the performance of the work:

Bodily Injury & Property Damage	$1,000,000.00 combined single limit

B. The policy shall include a CA 99 48 Broadened Pollution Endorsement. If specified in Exhibit A to the Owner – CONTRACTOR Agreement, the CONTRACTOR, if hauling contaminants and/or pollutants, must adhere to Sections 29 and 30 of the Motor Carrier Act of 1980, which shall include coverage Form MCS-90.

C. The policy shall include the CITY as an additional insured.

D. The policy shall contain a Waiver of Subrogation in favor of the CITY.

4. <u>Contractor's Pollution Liability.</u>

The CONTRACTOR shall purchase and maintain coverage for bodily injury and property damage resulting from liability arising out of pollution related exposures such as asbestos

abatement, lead paint abatement, tank removal, removal of contaminated soil, etc. The insurance policy shall cover the liability of the CONTRACTOR during the process of removal, storage, transport and disposal of hazardous waste and contaminated soil and/or asbestos abatement. The policy shall include coverage for on-Site and off-Site bodily injury and loss of, damage to, or loss of use of property, directly or indirectly arising out of the discharge, dispersal, release or escape of smoke, vapors, soot, fumes, acids, alkalis, toxic chemicals, liquids or gas, waste materials or other irritants, contaminants or pollutants into or upon the land, the atmosphere or any water course or body of water, whether it be gradual or sudden and accidental. The policy shall also include defense and clean-up costs. The CITY shall be named as an additional insureds and coverage must be on an occurrence basis. The amount of coverage shall be as follows:

Limit of liability $1,000,000 per occurrence
$3,000,000 aggregate

5. <u>Worker's Compensation.</u>

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

Worker's Compensation	Statutory limits
Employer's Liability	$ 1,000,000 each accident
	$ 1,000,000 disease per employee
	$ 1,000,000 disease policy aggregate

B. If specified in Article 5 of the General Conditions, the policy must be endorsed to cover United States Longshoremen & Harborworkers Act (USLHW), or Maritime Liability.

C. The policy shall contain a Waiver of Subrogation in favor of the CITY.

6. <u>Builder's Risk/ Installation Floater/Stored Materials.</u>

A. The CONTRACTOR shall purchase and maintain coverage against loss or damage on all Work included in this Contract in an amount equal to the Contract Price. Such coverage shall be written on an all risks basis or equivalent form and shall include, without limitation, insurance against perils of fire (with extended coverage) and physical loss or damage including, without duplication of coverage, theft, vandalism, malicious mischief, terrorism (“certified” and “non-certified”), collapse, earthquake, flood (if the project is not in an "A" or a "V" flood Zone), windstorm, falsework, testing and startup, temporary buildings and debris removal including demolition occasioned by enforcement of any applicable legal requirements, and shall cover reasonable compensation for Architect's and CONTRACTOR's services and expenses required as a result of such insured loss. Unless otherwise specified in this Contract, the limits for earthquake and flood shall be the lesser of the Contract Price or $10,000,000. This policy and/or installation floater shall include transportation and Stored Materials coverage in an amount equal to the value of the stored materials as required in **C**. below.

B. 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 Price. Such coverage shall be written on an all risks basis or equivalent form and shall include, without limitation, insurance against perils of fire (with extended coverage) and physical loss or damage

including, without duplication of coverage, theft, vandalism, malicious mischief, collapse, earthquake, flood (if the project is not in an "A" or a "V" flood Zone), windstorm, falsework, testing and startup, temporary buildings and debris removal including demolition occasioned by enforcement of any applicable legal requirements, and shall cover reasonable compensation for Architect's and CONTRACTOR's services and expenses required as a result of such insured loss. Unless otherwise specified in this Contract, the limits for earthquake and flood shall be the lesser of the Contract Price or $10,000,000. This policy and/or installation floater shall include transportation and Stored Materials coverage in an amount equal to the value of the stored materials as required in **C**. below.

C. The CONTRACTOR shall maintain insurance on delivered and/or stored material designated to be incorporated in the Work against fire, theft or other hazards. Any loss or damage of whatever nature to such material while stored at an off Site location shall be forthwith replaced by the CONTRACTOR at no expense to the CITY.

D. The policy or policies shall specifically state that they are for the benefit of and payable to the CITY, the CONTRACTOR, and all persons furnishing labor or labor and materials for the Contract Work, as their interests may appear. The policy or policies shall list the CITY, the CONTRACTOR, and Subcontractors of any tier as named insureds.

E. Coverage shall include any costs for work performed by the Designer or any consultant as the result of a loss experienced during the term of this Contract.

F. Coverage shall include permission for temporary occupancy and a Waiver of Subrogation in favor of the CITY.

G. Coverage shall be maintained until final acceptance by the CITY of the Contract and final payment has been made.

H. A loss under the property insurance shall be adjusted by the CONTRACTOR as fiduciary and made payable to the CONTRACTOR as fiduciary for the insureds. The CONTRACTOR shall pay the subcontractors their just shares of insurance proceeds received by the CONTRACTOR and shall require subcontractors to make payments to their sub-subcontractors in similar manner.

7. Umbrella Coverage.

The CONTRACTOR shall provide Umbrella Coverage in a form at least as broad as primary coverages required by Sections 2, 3 and 5 of this Article in the following amount:

Contract Price:	Limit of Liability:
Under $150,000	$1,000,000 per occurrence
$150,000 -- $1,000,000	$2,000,000 per occurrence
$1,000,001 -- $5,000,000	$5,000,000 per occurrence
$5,000,001-- $10,000,000	$10,000,000 per occurrence
$10,000,001 and over	$25,000,000 per occurrence

8. Additional Types of Insurance.

The CONTRACTOR shall provide such other types of insurance as may be required by Article 5 of the General Conditions.

ARTICLE 11: INDEMNIFICATION

A. To the fullest extent permitted by Laws and Regulations, CONTRACTOR shall indemnify, defend, and hold harmless Owner and Engineer and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or other dispute resolution costs) for or on account of or relating to any act, omission, or negligence of the CONTRACTOR, Subcontractors, or its or their agents or employees in the performance of the Work and/or their failure to comply with the terms and conditions of this Agreement. The foregoing provision shall not be deemed to be released, waived, or modified in any respect by reason of any surety or insurance provided by CONTRACTOR.

B. In any and all claims against Owner or Engineer or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors by any employee (or the survivor or personal representative of such employee) of CONTRACTOR, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, the indemnification obligation under this Agreement shall not be limited in any way by any limitation on the amount or type of damages, compensation, or benefits payable by or for CONTRACTOR or any such Subcontractor, Supplier, or other individual or entity under workers' compensation acts, disability benefit acts, or other employee benefit acts.

ARTICLE 12: MANDATORY ETHICS TRAINING

A summary of the Conflict of Interest Law is attached hereto as **Exhibit C** and must be distributed to all key employees of the Contractor pursuant to G.L. c. 268A. Questions regarding whether any of the Contractor's employees are considered "key employees" should be directed to the Legal Division of the State Ethics Commission at (617) 371-9500. Pursuant to Chapter 28 of the Acts of 2009, as amended, all key employees must complete online ethics training on the State Ethics Commission's website, www.mass.gov/ethics. Within thirty days of the date of this Agreement, each key employee must provide to the City a signed acknowledgment of receipt of the summary of the Conflict of Interest Law, in the form attached hereto as **Exhibit D,** and a certificate of completion of the online training which must be printed at the completion of the training. In the event that the term of this Agreement extends for more than two years, all continuously employed key employees shall repeat the online training and provide the City with a new certificate of completion within ninety days before or ninety days after the two-year anniversary of the date of this Agreement. Any new key employee who becomes employed by the Contractor after the date of this Agreement and whose services are specifically required by this Agreement must complete the online training and provide the City with a certificate of completion within thirty days of the date on which his services commence pursuant to this Agreement. Satisfaction of these requirements is the sole responsibility of the Contractor and its key employees, and the City shall have no liability for the Contractor's or its key employees' failure to meet these requirements.

ARTICLE 13: AFFIRMATIVE ACTION AND EQUAL EMPLOYMENT OPPORTUNITY

CONTRACTOR shall comply with the requirements of G.L. c. 151 governing non-discrimination in employment; City of Framingham Local Affirmative Action Requirements; and the Affirmative Action & Equal Employment Opportunity Requirements attached hereto as Exhibit E.

ARTICLE 14: MISCELLANEOUS

A. This Agreement shall be binding upon the CITY and the CONTRACTOR and the partners, successors, heirs, executors, administrators, assigns and legal representatives of the CITY and the CONTRACTOR. Neither the CITY nor the CONTRACTOR shall assign, subcontract, sublet or transfer any interest in this Agreement without the written consent of each other, and such consent shall not be unreasonably withheld.

B. Terms used in this Agreement will have the meanings stated in the General Conditions and the Supplementary Conditions.

C. Any provision or part of the Contract Documents held to be void or unenforceable under any Law or Regulation shall be deemed stricken, and all remaining provisions shall continue to be valid and binding upon CITY and CONTRACTOR, who agree that the Contract Documents shall be reformed to replace such stricken provision or part thereof with a valid and enforceable provision that comes as close as possible to expressing the intention of the stricken provision.

THE REMAINDER OF THIS PAGE IS LEFT BLANK INTENTIONALLY

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

*If a Corporation, attach to each signed copy of this Contract an attested copy of the vote of the Corporation on authorizing the said signing and sealing.

CONTRACTOR: _____

BY**:** _____

Title: _____

Dated:_____

Corporate Seal:

_____
William R. Sedewitz, P.E.
Chief Engineer
Department of Public Works

Dated:_____

Approved as To Form

_____
Jennifer A. Pratt
Chief Procurement Officer

Dated:_____

_____
Christopher J. Petrini
City Solicitor

Dated:_____

Approved as to Funds Availability
Pursuant to M.G.L. c. 44, §31C, I certify that an appropriation has been made in the total amount of the contract.

_____
Richard G. Howarth
City Accountant

Dated:_____

_____
Thatcher W. Kezer III
Chief Operating Officer

Dated_____

Funding Source:

PW-428

EXHIBIT A - PERFORMANCE BOND

Bond No. _____

KNOW ALL MEN BY THESE PRESENT, that we _____ with a place of business at _____ as principal (the "Principal"), and _____, a corporation qualified to do business in the Commonwealth of Massachusetts, with a place of business at _____ as Surety (the "Surety"), are held and firmly bound unto the City of Framingham as Obligee (the "Obligee"), in the sum of _____ lawful money of the United States of America, to be paid to the Obligee, for which payment, well and truly to be made, we bind ourselves, our respective heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these present.

WHEREAS, the Principal has assumed and made a contract with the Obligee, bearing the date of _____, for the **PW-428 Edgell Road Water Pump Station Replacement**]

NOW THE CONDITIONS of this obligation are such that if the Principal and all SubCONTRACTORs under said contract shall well and truly keep and perform all the undertakings, covenants, agreement, terms, and conditions of said contract on its part to be kept and performed during the original term of said contract and any extensions thereof that may be granted by the Obligee, with or without notice to the Surety, and during the life and any guarantee required under the contract, and shall also well and truly keep and perform all the undertakings, covenants, agreements, terms and conditions of any and all duly authorized modifications, alterations, changes or additions being hereby waived, then this obligation shall become null and void; otherwise, it shall remain in full force and virtue.

IN THE EVENT the Contract is abandoned by the Principal, or is terminated by the City of Framingham under the applicable provisions of the Contract, the Surety hereby further agrees that the Surety shall, if requested in writing by the City of Framingham promptly take such action as is necessary to complete said Contract in accordance with its terms and conditions.

IN WITNESS WHEREOF, the Principal and Surety have hereto set their hands and seals this _____ day of _____, 2020.

PRINCIPAL	SURETY
_____	_____
_____	_____
[Name and Seal]	[Attorney-In-Fact]
_____	_____
[Title]	[Address]
	_____
	[Phone]
Attest:_____	Attest:_____

The rate of the Bond is _____% of the first $_____ and _____% for the next $_____.

The total premium for this Bond is $_____.

END OF PERFORMANCE BOND

EXHIBIT B - PAYMENT BOND

Bond No. _____

KNOW ALL MEN BY THESE PRESENT, that we _____ with a place of business at _____ as principal (the "Principal"), and _____, a corporation qualified to do business in the Commonwealth of Massachusetts, with a place of business at _____ as Surety (the "Surety"), are held and firmly bound unto City of Framingham as Obligee (the "Obligee"), in the sum of _____ lawful money of the United States of America, to be paid to the Obligee, for which payment, well and truly to be made, we bind ourselves, our respective heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these present.

WHEREAS, the Principal has assumed and made a contract with the Obligee, bearing the date of _____-_____, for the **PW-428 Edgell Road Water Pump Station Replacement]**.

NOW, THE CONDITIONS of this obligation are such that if the Principal and all subCONTRACTORs under said contract shall pay for all labor performed or furnished and for all materials used or employed in said contract and in any and all duly authorized modifications, alterations, extensions of time, changes or additions to said contract that may hereafter be made, notice to the Surety of such modifications, alterations, extensions of time, changes or additions being hereby waived, the foregoing to include any other purposes or items set out in, and to be subject to, the provisions of Massachusetts General Laws, Chapter 30, Section 39A, and Chapter 149, Section 29, as amended then this obligation shall become null and void; otherwise, it shall remain in full force and virtue.

IN WITNESS WHEREFORE, the Principal and Surety have hereto set their hands and seals this _____ day of _____, 2020.

PRINCIPAL	SURETY
_____	_____
_____	_____
[Name and Seal]	[Attorney-In-Fact][Seal]
_____	_____
[Title]	[Address]
	_____
	[Phone]
Attest:_____	Attest:_____

The rate for this Bond is _____% of the first $_____ and _____% for the next $_____.

The total premium for this Bond is $_____.

END OF PAYMENT BOND

EXHIBIT C - Mandatory Training Requirements - Summaries and Online Training

Mandatory educational requirements under the Ethics Reform Bill

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Summary of the Conflict of Interest Law for Municipal Employees

By December 28, 2009, and on an annual basis thereafter, all current municipal employees must be provided with this summary of the conflict of interest law. Municipal employees hired after December 28, 2009, should be provided with the summary within 30 days of the date on which they commence employment, and on an annual basis thereafter. Every municipal employee is required to sign a written acknowledgment that he has been provided with the summary.

Online Training Program

www.mass.gov/ethics - Under Education & Training Resources

By 12/28/09, and every 2 years thereafter, all current state, county and municipal employees must complete this training. Public employees hired after 12/28/09 must complete this training within 30 days of beginning public service, and every 2 years thereafter. This training is designed primarily for state employees. County and municipal employees should also use this training until it is revised with one tailored to them. Upon completing the program, employees should print out the completion certificate and keep a copy for themselves. Employees will be required to provide a copy of the completion certificate to the Town or City Clerk (municipal employees), their employing agency (appointed state and county employees), or to the Ethics Commission (elected state and county employees). Completing the single program will be considered by the Commission as meeting the Bill's training requirements until a second program is added. When multiple users attempt to complete the current training program using the same computer they may experience a problem accessing the beginning of the program. The user will need to open their internet browser, click on "Tools", then "Internet Options", select "Delete Cookies", then click "OK". The user will be able to click back on the Online Training module on the Commission's website and start at the beginning.

****

After you have completed the Online Training, print out the "State Ethics Commission Receipt", and return with the receipt on Page 9 of this packet "Conflict of Interest Law" .

Summary of the Conflict of Interest Law for Municipal Employees

This summary of the conflict of interest law, General Laws chapter 268A, is intended to help municipal employees understand how that law applies to them. This summary is not a substitute for legal advice, nor does it mention every aspect of the law that may apply in a particular situation. Municipal employees can obtain free confidential advice about the conflict of interest law from the Commission's Legal Division at our website, phone number, and address above. Municipal counsel may also provide advice.

The conflict of interest law seeks to prevent conflicts between private interests and public duties, foster integrity in public service, and promote the public's trust and confidence in that service by placing restrictions on what municipal employees may do on the job, after hours, and after leaving public service, as described below. The sections referenced below are sections of G.L. c. 268A.

When the Commission determines that the conflict of interest law has been violated, it can impose a civil penalty of up to $10,000 ($25,000 for bribery cases) for each violation. In addition, the Commission can order the violator to repay any economic advantage he gained by the violation, and to make restitution to injured third parties. Violations of the conflict of interest law can also be prosecuted criminally.

I. Are you a municipal employee for conflict of interest law purposes?

You do not have to be a full-time, paid municipal employee to be considered a municipal employee for conflict of interest purposes. Anyone performing services for a city or town or holding a municipal position, whether paid or unpaid, including full- and part-time municipal employees, elected officials, volunteers, and consultants, is a municipal employee under the conflict of interest law. An employee of a private firm can also be a municipal employee, if the private firm has a contract with the city or town and the employee is a "key employee" under the contract, meaning the town has specifically contracted for her services. The law also covers private parties who engage in impermissible dealings with municipal employees, such as offering bribes or illegal gifts.

II. On-the-job restrictions.

(a) Bribes. Asking for and taking bribes is prohibited.
(See Section 2)
A bribe is anything of value corruptly received by a municipal employee in exchange for the employee being influenced in his official actions. Giving, offering, receiving, or asking for a bribe is illegal.

Bribes are more serious than illegal gifts because they involve corrupt intent. In other words, the municipal employee intends to sell his office by agreeing to do or not do some official act, and the giver intends to influence him to do so. Bribes of any value are illegal.

(b) Gifts and gratuities. Asking for or accepting a gift because of your official position, or because of something you can do or have done in your official position, is prohibited. (See Sections 3, 23(b)(2), and 26)
Municipal employees may not accept gifts and gratuities valued at $50 or more given to influence their official actions or because of their official position. Accepting a gift intended to reward past official action or to bring about future official action is illegal, as is giving such gifts. Accepting a gift given to you because of the municipal position you hold is also illegal. Meals, entertainment event tickets, golf, gift baskets, and payment of travel expenses can all be illegal gifts if given in connection with official action or position, as can anything worth $50 or more. A number of smaller gifts together worth $50 or more may also violate these sections.

Example of violation: A town administrator accepts reduced rental payments from developers.

Example of violation: A developer offers a ski trip to a school district employee who oversees the developer's work for the school district.

Regulatory exemptions. There are situations in which a municipal employee's receipt of a gift does not present a genuine risk of a conflict of interest, and may in fact advance the public interest. The Commission has created exemptions, and is considering creating additional exemptions, permitting giving and receiving gifts in these situations. One commonly used exemption permits municipal employees to accept payment of travel-related expenses when doing so advances a public purpose. Other exemptions are listed on the Commission's website.

Example where there is no violation: A fire truck manufacturer offers to pay the travel expenses of a fire chief to a trade show where the chief can examine various kinds of fire-fighting equipment that the town may purchase. The chief fills out a disclosure form and obtains prior approval from his appointing authority.

(c) Misuse of position. Using your official position to get something you are not entitled to, or to get someone else something they are not entitled to, is prohibited. Causing someone else to do these things is also prohibited. (See Sections 23(b)(2) and 26)
A municipal employee may not use her official position to get something worth $50 or more that would not be properly available to other similarly situated individuals. Similarly, a municipal employee may not use her official position to get something worth $50 or more for someone else that would not be properly available to other similarly situated individuals. Causing someone else to do these things is also prohibited.

Example of violation: A full-time town employee writes a novel on work time, using her office computer, and directing her secretary to proofread the draft.

Example of violation: A city councilor directs subordinates to drive the councilor's wife to and from the grocery store.

Example of violation: A mayor avoids a speeding ticket by asking the police officer who stops him, "Do you know who I am?" and showing his municipal I.D.

(d) Self-dealing and nepotism. Participating as a municipal employee in a matter in which you, your immediate family, your business organization, or your future employer has a financial interest is prohibited. (See Section 19)
A municipal employee may not participate in any particular matter in which he or a member of his immediate family (parents, children, siblings, spouse, and spouse's parents, children, and siblings) has a financial interest. He also may not participate in any particular matter in which a prospective employer, or a business organization of which he is a director, officer, trustee, or employee has a financial interest. Participation includes discussing as well as voting on a matter, and delegating a matter to someone else.

A financial interest may create a conflict of interest whether it is large or small, and positive or negative. In other words, it does not matter if a lot of money is involved or only a little. It also does not matter if you are putting money into your pocket or taking it out. If you, your immediate family, your business, or your employer have or has a financial interest in a matter, you may not participate. The financial interest must be direct and immediate or reasonably foreseeable to create a conflict. Financial interests which are remote, speculative or not sufficiently identifiable do not create conflicts.

Example of violation: A school committee member's wife is a teacher in the town's public schools. The school committee member votes on the budget line item for teachers' salaries.

Example of violation: A member of a town affordable housing committee is also the director of a non-profit housing development corporation. The non-profit makes an application to the committee, and the member/director participates in the discussion.

Example: A planning board member lives next door to property where a developer plans to construct a new building. Because the planning board member owns abutting property, he is presumed to have a financial interest in the matter. He cannot participate unless he provides the State Ethics Commission with an opinion from a qualified independent appraiser that the new construction will not affect his financial interest.

In many cases, where not otherwise required to participate, a municipal employee may comply with the law by simply not participating in the particular matter in which she has a financial interest. She need not give a reason for not participating.

There are several exemptions to this section of the law. An appointed municipal employee may file a written disclosure about the financial interest with his appointing authority, and seek permission to participate notwithstanding the conflict. The appointing authority may grant written permission if she determines that the financial interest in question is not so substantial that it is likely to affect the integrity of his services to the municipality. Participating without disclosing the financial interest is a violation. Elected employees cannot use the disclosure procedure because they have no appointing authority.

Example where there is no violation: An appointed member of the town zoning advisory committee, which will review and recommend changes to the town's by-laws with regard to a

commercial district, is a partner at a company that owns commercial property in the district. Prior to participating in any committee discussions, the member files a disclosure with the zoning board of appeals that appointed him to his position, and that board gives him a written determination authorizing his participation, despite his company's financial interest. There is no violation.

There is also an exemption for both appointed and elected employees where the employee's task is to address a matter of general policy and the employee's financial interest is shared with a substantial portion (generally 10% or more) of the town's population, such as, for instance, a financial interest in real estate tax rates or municipal utility rates.

(e) False claims. Presenting a false claim to your employer for a payment or benefit is prohibited, and causing someone else to do so is also prohibited. (See Sections 23(b)(4) and 26)
A municipal employee may not present a false or fraudulent claim to his employer for any payment or benefit worth $50 or more, or cause another person to do so.

Example of violation: A public works director directs his secretary to fill out time sheets to show him as present at work on days when he was skiing.

(f) Appearance of conflict. Acting in a manner that would make a reasonable person think you can be improperly influenced is prohibited. (See Section 23(b)(3))
A municipal employee may not act in a manner that would cause a reasonable person to think that she would show favor toward someone or that she can be improperly influenced. Section 23(b)(3) requires a municipal employee to consider whether her relationships and affiliations could prevent her from acting fairly and objectively when she performs her duties for a city or town. If she cannot be fair and objective because of a relationship or affiliation, she should not perform her duties. However, a municipal employee, whether elected or appointed, can avoid violating this provision by making a public disclosure of the facts. An appointed employee must make the disclosure in writing to his appointing official.

Example where there is no violation: A developer who is the cousin of the chair of the conservation commission has filed an application with the commission. A reasonable person could conclude that the chair might favor her cousin. The chair files a written disclosure with her appointing authority explaining her relationship with her cousin prior to the meeting at which the application will be considered. There is no violation of Sec. 23(b)(3).

(g) Confidential information. Improperly disclosing or personally using confidential information obtained through your job is prohibited. (See Section 23(c))
Municipal employees may not improperly disclose confidential information, or make personal use of non-public information they acquired in the course of their official duties to further their personal interests.

III. After-hours restrictions.

(a) Taking a second paid job that conflicts with the duties of your municipal job is prohibited. (See Section 23(b)(1))

A municipal employee may not accept other paid employment if the responsibilities of the second job are incompatible with his or her municipal job.

Example: A police officer may not work as a paid private security guard in the town where he serves because the demands of his private employment would conflict with his duties as a police officer.

(b) Divided loyalties. Receiving pay from anyone other than the city or town to work on a matter involving the city or town is prohibited. Acting as agent or attorney for anyone other than the city or town in a matter involving the city or town is also prohibited whether or not you are paid. (See Sec. 17)
Because cities and towns are entitled to the undivided loyalty of their employees, a municipal employee may not be paid by other people and organizations in relation to a matter if the city or town has an interest in the matter. In addition, a municipal employee may not act on behalf of other people and organizations or act as an attorney for other people and organizations in which the town has an interest. Acting as agent includes contacting the municipality in person, by phone, or in writing; acting as a liaison; providing documents to the city or town; and serving as spokesman.

A municipal employee may always represent his own personal interests, even before his own municipal agency or board, on the same terms and conditions that other similarly situated members of the public would be allowed to do so. A municipal employee may also apply for building and related permits on behalf of someone else and be paid for doing so, unless he works for the permitting agency, or an agency which regulates the permitting agency.

Example of violation: A full-time health agent submits a septic system plan that she has prepared for a private client to the town's board of health.

Example of violation: A planning board member represents a private client before the board of selectmen on a request that town meeting consider rezoning the client's property.

While many municipal employees earn their livelihood in municipal jobs, some municipal employees volunteer their time to provide services to the town or receive small stipends. Others, such as a private attorney who provides legal services to a town as needed, may serve in a position in which they may have other personal or private employment during normal working hours. In recognition of the need not to unduly restrict the ability of town volunteers and part-time employees to earn a living, the law is less restrictive for "special" municipal employees than for other municipal employees.

The status of "special" municipal employee has to be assigned to a municipal position by vote of the board of selectmen, city council, or similar body. A position is eligible to be designated as "special" if it is unpaid, or if it is part-time and the employee is allowed to have another job during normal working hours, or if the employee was not paid for working more than 800 hours during the preceding 365 days. It is the position that is designated as "special" and not the person or persons holding the position. Selectmen in towns of 10,000 or fewer are automatically "special"; selectman in larger towns cannot be "specials."

If a municipal position has been designated as "special," an employee holding that position may be paid by others, act on behalf of others, and act as attorney for others with respect to matters before municipal boards other than his own, provided that he has not officially participated in the matter, and the matter is not now, and has not within the past year been, under his official responsibility.

Example: A school committee member who has been designated as a special municipal employee appears before the board of health on behalf of a client of his private law practice, on a matter that he has not participated in or had responsibility for as a school committee member. There is no conflict. However, he may not appear before the school committee, or the school department, on behalf of a client because he has official responsibility for any matter that comes before the school committee. This is still the case even if he has recused himself from participating in the matter in his official capacity.

Example: A member who sits as an alternate on the conservation commission is a special municipal employee. Under town by-laws, he only has official responsibility for matters assigned to him. He may represent a resident who wants to file an application with the conservation commission as long as the matter is not assigned to him and he will not participate in it.

(c) Inside track. Being paid by your city or town, directly or indirectly, under some second arrangement in addition to your job is prohibited, unless an exemption applies. (See Section 20) A municipal employee generally may not have a financial interest in a municipal contract, including a second municipal job. A municipal employee is also generally prohibited from having an indirect financial interest in a contract that the city or town has with someone else. This provision is intended to prevent municipal employees from having an "inside track" to further financial opportunities.

Example of violation: Legal counsel to the town housing authority becomes the acting executive director of the authority, and is paid in both positions.

Example of violation: A selectman buys a surplus truck from the town DPW.

Example of violation: A full-time secretary for the board of health wants to have a second job working part-time for the town library. She will violate Section 20 unless she can meet the requirements of an exemption.

Example of violation: A city councilor wants to work for a non-profit that receives funding under a contract with her city. Unless she can satisfy the requirements of an exemption under Section 20, she cannot take the job.

There are numerous exemptions. A municipal employee may hold multiple unpaid or elected positions. Some exemptions apply only to special municipal employees. Specific exemptions may cover housing-related benefits, public safety positions, certain elected positions, small

towns, and other specific situations. Please call the Ethics Commission's Legal Division for advice about a specific situation.

IV. After you leave municipal employment. (See Section 18)

(a) Forever ban. After you leave your municipal job, you may never work for anyone other than the municipality on a matter that you worked on as a municipal employee.
If you participated in a matter as a municipal employee, you cannot ever be paid to work on that same matter for anyone other than the municipality, nor may you act for someone else, whether paid or not. The purpose of this restriction is to bar former employees from selling to private interests their familiarity with the facts of particular matters that are of continuing concern to their former municipal employer. The restriction does not prohibit former municipal employees from using the expertise acquired in government service in their subsequent private activities.

Example of violation: A former school department employee works for a CONTRACTOR under a contract that she helped to draft and oversee for the school department.

(b) One year cooling-off period. For one year after you leave your municipal job you may not participate in any matter over which you had official responsibility during your last two years of public service.
Former municipal employees are barred for one year after they leave municipal employment from personally appearing before any agency of the municipality in connection with matters that were under their authority in their prior municipal positions during the two years before they left.

Example: An assistant town manager negotiates a three-year contract with a company. The town manager who supervised the assistant, and had official responsibility for the contract but did not participate in negotiating it, leaves her job to work for the company to which the contract was awarded. The former manager may not call or write the town in connection with the company's work on the contract for one year after leaving the town.

(c) Partners. Your partners will be subject to restrictions while you serve as a municipal employee and after your municipal service ends.
Partners of municipal employees and former municipal employees are also subject to restrictions under the conflict of interest law. If a municipal employee participated in a matter, or if he has official responsibility for a matter, then his partner may not act on behalf of anyone other than the municipality or provide services as an attorney to anyone but the city or town in relation to the matter.

Example: While serving on a city's historic district commission, an architect reviewed an application to get landmark status for a building. His partners at his architecture firm may not prepare and sign plans for the owner of the building or otherwise act on the owner's behalf in relation to the application for landmark status. In addition, because the architect has official responsibility as a commissioner for every matter that comes before the commission, his partners may not communicate with the commission or otherwise act on behalf of any client on any matter that comes before the commission during the time that the architect serves on the commission.

Example: A former town counsel joins a law firm as a partner. Because she litigated a lawsuit for the town, her new partners cannot represent any private clients in the lawsuit for one year after her job with the town ended.

* * * * *

This summary is not intended to be legal advice and, because it is a summary, it does not mention every provision of the conflict law that may apply in a particular situation. Our website, www.mass.gov/ethics, contains further information about how the law applies in many situations. You can also contact the Commission's Legal Division via our website, by telephone, or by letter. Our contact information is at the top of this document.

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EXHIBIT D – Ethics Law Receipt

In accordance with Massachusetts General Laws, Chapter 303 of the Acts of 1975, I have been furnished a copy of the Conflict of Interest Law.

_____

Print Name

_____

Department / Office / Board / Committee

_____

Address

_____

City or Town, State & Zip

_____

Phone

_____

Email

Please sign below and return to the City Clerk's Office as required by law.

_____ State Ethics Commission Receipt Included

_____ _____

Signature ***Date***

EXHIBIT E - Affirmative Action & Equal Employment Opportunity Requirements

Pursuant to Article X, Section 1 of the Framingham Home Rule Charter adopted on April 4, 2017 "All general laws, special laws, town by-laws, town meeting votes, and rules and regulations of or pertaining to Framingham that are in force when this charter takes effect, and not specifically or by implication repealed by this charter, shall continue in full force and effect until amended or repealed, or rescinded by due course of law, or until they expire by their own limitation…"

Section 1 - AFFIRMATIVE ACTION REQUIREMENTS
Bidders are advised of the requirements of the following City By-law, which was adopted at the Special Framingham Town Meeting of December 8, 1971 and approved by the Attorney General on March 14, 1972.

Section 2 - No City agency shall enter into any contract for the purchase of goods or services for the construction, maintenance, renovation or repair of any building, structure, street, way, utility or other public works with any contractor which does not take affirmative action to provide equal employment for all qualified persons without regard to race, color, religion, sex or national origin.

Section 3 - Each bidder and contractor shall include with all bids and all compliance and progress reports submitted to any agency or a report, which shall include:

A certificate stating that he is currently in compliance with the provisions of the Massachusetts General Laws, Chapter 151 governing non discrimination in employment and setting forth the affirmative action he is currently undertaking and will undertake during the contract period to provide equal employment opportunity for all qualified persons without regard to race, color, religion, sex or national origin. A copy of any such report shall be filed in the office of the Town Clerk and shall upon filing become a public record.

Section 4 - Every Town Agency shall include in every contract hereinafter entered into the purchase of goods or services or for the construction, maintenance, renovation services or repair of any buildings, structure, street, way utility or other public works the following provisions:
During the performance of this contract, the contractor agrees as follows:

a. The contractor will take affirmative action to ensure that employees are solicited and employed and that the employees are treated during employment without regard to race, color, religion, sex or national origin.

b. The contractor will in all solicitation or advertisements for employees placed by on behalf of the contractor, state that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex or national origin.

c. The contractor and subcontractors will include the provisions of subsections (a) and (b) above in every subcontract or purchase order.

Section 5 - As used in this section, affirmative action means positive steps to ensure all qualified persons equal employment without regard to race, color, religion, sex or national origin at all stages of the employment process, recruitment, selection, placement, promotion, training, layoff and termination. It may include, but not limited to the following:

- Inclusion in all solicitation and advertisements for employees of a statement that the contractor is an "Equal Opportunity Employer."
- Placement of solicitation and advertisements for employees in media that reaches minority groups.
- Notification in writing of all recruitment sources that the contractor solicits the referral of applicants without regard to race, color, religion, sex or national origin.
- Direct solicitation of the support of responsible and appropriate community, state and federal agencies to assist in recruitment efforts.
- Participation is or establishment of apprenticeship or training programs where outside programs are inadequate or unavailable to minority groups.
- Modification or collective bargaining agreements to eliminate restrictive barriers established by dual lines of seniority, dual rates of pay or dual lines of promotion or progression which are based on race, color, religion, sex or national origin.

Section 6 - The Human Relations Commission shall receive and investigate or cause to be investigated complaints by employees or prospective employees of a Town contractor, subcontractor, or supplier. Findings and determinations on such investigations, together with the records and recommendations, shall be reported by the Human Relations Commission to the Board of Selectmen and the contracting agency concerned. The Human Relations Commission shall cooperate with the Board of Selectmen and with each contracting agency by providing assistance in reviewing affirmative action plans, and to contractors seeking qualified minority group employees, and shall itself seek such employees.

Section 7 - The provision of this section shall not apply to any contract for less than $5,000 or to bidders and contractors employing fewer than six persons provided that where the contract is for less than $5,000 but not less than $2,000, any Town agency may apply the provision of this section to any contract, bidder, or contractor.

EQUAL EMPLOYMENT OPPORTUNITY

No person in the United States shall, on the grounds of race, color, national origin, or sex, be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any program or activity receiving Federal financial assistance. Reference Title VI of the Civil Rights Act of 1964 (42 USC 2000d) and Section 112 of Public Law 92-65.

Form EDA-503. The Recipient and all Contractors, subcontractors, suppliers, lessees and other parties directly participating in the Recipient's project agree that during and in connection with the associated agreement relating to the Federally assisted program.
(1) They will comply, to the extent applicable, as Contractors, subcontractors, lessees, suppliers, or in any other capacity, with the applicable provisions of the Regulations of the United States Department of Commerce (Part 8 of Subtitle A of Title 15 of the Code of Federal Regulations) issued pursuant to Title VI of the Civil Rights Act of 1964 (P.L. 88-352), and will not thereby

discriminate against any person on the grounds of race, color, or national origin in their employment practices, in any of their own contractual arrangements, in all services or accommodations which they offer to the public, and in any of their other business operations, (2) they will provide information required by or pursuant to said Regulations to ascertain compliance with the Regulations and these assurances, and (3) their non-compliance with the nondiscrimination requirements of said Regulations and these assurances shall constitute a breach of their contractual arrangements with the Recipient whereby said agreements may be canceled, terminated or suspended in whole or in part or may be subject to enforcement otherwise by appropriate legal proceedings.

Executive Order 11246, 30 Fed. Reg. 12319 (1965) (Equal Opportunity Clause)
During the performance of this contract, the Contractor agrees as follows:

a. The Contractor will no discriminate against any employee or applicant for employment because of race, color, religion, sex, or national origin. The Contractor will take affirmative action to ensure the applicants, are employed, and that employees are treated during employment, without regard to their race, color, religion, sex, or national origin. Such action shall include, but not be limited to the following: employment, upgrading, demotion, or transfer; recruitment or recruitment advertising, layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship.

b. The Contractor agrees to post in conspicuous places available to employees and applicants for employment, notices to be provided by the contracting officer setting forth the provisions of this non-discrimination clause.

c. The Contractor will, in all solicitations or advertisements for employees placed by or on behalf of the contractor, state that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex, or national origin.

d. The Contractor will send to each labor union or representative of workers with which he has a collective bargaining agreement or other contract or understanding, a notice to be provided by the agency contracting officer, advising the labor union or workers' representative of the Contractor's commitment under Section 202 of Executive Order No. 11246 of September 24, 1965, and shall post copies of the notice in conspicuous places available to employees and applicants for employment.

e. The Contractor will comply with all provisions of Executive Order No. 11246 of September 24, 1965, and of rules, regulations, and relevant orders of the Secretary of Labor.

f. The Contractor will furnish all information and reports required by Executive Order No. 11246 of September 24, 1965, and by rules, regulations, and orders of the Secretary of Labor, or pursuant thereto, and will permit access to his books, record, and accounts by the contracting agency and the Secretary of Labor for purposes of investigation to ascertain compliance with such rules, regulations, and orders. Each Contractor and subcontractor of federally financed construction work is required to file an Equal Employment Opportunity Employer Information Report (EEO-1 on Standard Form 100) annually on March 31. Forms and instructions are available at the EDA Regional Office.

g. In the event of the Contractor' noncompliance with the non-discrimination clauses of this contract or with any such rules, regulations, or orders, this contract may be canceled, terminated or suspended in whole or in part and the Contractor may be declared ineligible for further Government contracts in accordance with procedures authorized in Executive Order No. 11246 of September 24, 1965, and such other sanctions may be imposed (and remedies involved) as provided in Executive Order No. 11246 of September 24, 1965, or by rule, regulation, or order of the Secretary of Labor, or as otherwise provided by law.

h. The Contractor will include the provisions of paragraphs a through h in every subcontract or purchase order unless exempted by rules, regulations, or orders of the Secretary of Labor issued pursuant to Section 204 of Executive Order No. 11246 of September 24, 1965, so that such provisions will be binding upon each subcontractor or vendor. The Contractor will take such action with respect to any subcontractor or purchase order as the contracting agency may direct as a means of enforcing such provisions including sanctions for noncompliance; Provided, however, that in the event the contractor becomes involved in, or is threatened with litigation with a subcontractor or vendor as a result of such direction by the contracting agency, the Contractor may request the United States to enter into such litigation to protect the interest of the United States.

1. Exemptions to Above Equal Opportunity Clause (4) CFR Chap.60):

(1) Contracts and subcontracts not exceeding $10,000 (other than government bills of lading) are exempt. The amount of the contract, rather than the amount of the Federal financial assistance, shall govern in determining the applicability of this exemption.

(2) Except in the case of subcontractors for the performance of construction work at the site of construction, the clause shall not be required to be inserted in subcontracts below the second tier.

(3) Contracts and subcontracts not exceeding $100,000 for standard commercial supplies or raw materials are exempt.

OTHER PROHIBITED INTEREST

No official of the Owner who is authorized in such capacity and on behalf of the Owner to negotiate, make, accept, or approve, or to take part in negotiating, making, accepting, or approving any architectural, engineering, inspection, construction or material supply contract or any subcontract in connection with the construction of the project, shall become directly or indirectly interested personally in this contract or in any part hereof. No officer, employee, architect, attorney, engineer or inspector of or for the Owner who is authorized in such capacity and on behalf of the Owner to exercise any legislative, executive, supervisory or other similar functions in connection with the construction of the project, shall become directly or indirectly interest personally in this contract or in any part thereof, any material supply contract, subcontract, insurance contract, or any other contract pertaining to the project.

City of Framingham, Massachusetts

Date_____

To: City of Framingham, Framingham, MA

I have read the Affirmative Action Requirements and Equal Employment Opportunity as adopted by the Town of Framingham on December 8, 1971 and approved by the Massachusetts Attorney General on March 14, 1972 and agree to affirmatively implement all practices necessary to comply with said requirements.

A copy of a portion of the City By-law is attached as part of the bid specifications.

Signed_____ _____
Name Title

Company_____

Contract No.: **PW # 428** For: [Edgell Rd. Water Pump Station Replacement]

SECTION C: PREVAILING WAGE REQUIREMENTS

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

Prevailing Wage Rates

CHARLES D. BAKER
Governor

KARYN E. POLITO
Lt. Governor

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: City of Framingham

Contract Number: PW-428 **City/Town:** FRAMINGHAM

Description of Work: Replace the existing Edgell Road Water Pumping Station, and the adjacent water distribution system components.

Job Location: Edgell Rd. Framingham MA

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 *TEAMSTERS JOINT COUNCIL NO. 10 ZONE B*	12/01/2019	$34.25	$12.41	$13.72	$0.00	$60.38
	06/01/2020	$35.15	$12.41	$13.72	$0.00	$61.28
	08/01/2020	$35.15	$12.91	$13.72	$0.00	$61.78
	12/01/2020	$35.15	$12.91	$14.82	$0.00	$62.88
	06/01/2021	$35.95	$12.91	$14.82	$0.00	$63.68
	08/01/2021	$35.95	$13.41	$14.82	$0.00	$64.18
	12/01/2021	$35.95	$13.41	$16.01	$0.00	$65.37
(3 AXLE) DRIVER - EQUIPMENT *TEAMSTERS JOINT COUNCIL NO. 10 ZONE B*	12/01/2019	$34.32	$12.41	$13.72	$0.00	$60.45
	06/01/2020	$35.22	$12.41	$13.72	$0.00	$61.35
	08/01/2020	$35.22	$12.91	$13.72	$0.00	$61.85
	12/01/2020	$35.22	$12.91	$14.82	$0.00	$62.95
	06/01/2021	$36.02	$12.91	$14.82	$0.00	$63.75
	08/01/2021	$36.02	$13.41	$14.82	$0.00	$64.25
	12/01/2021	$36.02	$13.41	$16.01	$0.00	$65.44
(4 & 5 AXLE) DRIVER - EQUIPMENT *TEAMSTERS JOINT COUNCIL NO. 10 ZONE B*	12/01/2019	$34.44	$12.41	$13.72	$0.00	$60.57
	06/01/2020	$35.34	$12.41	$13.72	$0.00	$61.47
	08/01/2020	$35.34	$12.91	$13.72	$0.00	$61.97
	12/01/2020	$35.34	$12.91	$14.82	$0.00	$63.07
	06/01/2021	$36.14	$12.91	$14.82	$0.00	$63.87
	08/01/2021	$36.14	$13.41	$14.82	$0.00	$64.37
	12/01/2021	$36.14	$13.41	$16.01	$0.00	$65.56
ADS/SUBMERSIBLE PILOT *PILE DRIVER LOCAL 56 (ZONE 1)*	08/01/2019	$102.78	$9.90	$21.15	$0.00	$133.83
For apprentice rates see "Apprentice- PILE DRIVER"						
AIR TRACK OPERATOR *LABORERS - ZONE 2*	12/01/2019	$34.81	$8.10	$15.38	$0.00	$58.29
	06/01/2020	$35.70	$8.10	$15.38	$0.00	$59.18
	12/01/2020	$36.59	$8.10	$15.38	$0.00	$60.07
	06/01/2021	$37.51	$8.10	$15.38	$0.00	$60.99
	12/01/2021	$38.42	$8.10	$15.38	$0.00	$61.90
For apprentice rates see "Apprentice- LABORER"						
ASBESTOS REMOVER - PIPE / MECH. EQUIPT. *HEAT & FROST INSULATORS LOCAL 6 (BOSTON)*	12/01/2019	$37.00	$12.50	$8.85	$0.00	$58.35
	06/01/2020	$38.00	$12.50	$8.85	$0.00	$59.35
	12/01/2020	$39.00	$12.50	$8.85	$0.00	$60.35
ASPHALT RAKER *LABORERS - ZONE 2*	12/01/2019	$34.31	$8.10	$15.38	$0.00	$57.79
	06/01/2020	$35.20	$8.10	$15.38	$0.00	$58.68
	12/01/2020	$36.09	$8.10	$15.38	$0.00	$59.57
	06/01/2021	$37.01	$8.10	$15.38	$0.00	$60.49
	12/01/2021	$37.92	$8.10	$15.38	$0.00	$61.40
For apprentice rates see "Apprentice- LABORER"						
ASPHALT/CONCRETE/CRUSHER PLANT-ON SITE *OPERATING ENGINEERS LOCAL 4*	12/01/2019	$48.73	$12.50	$15.70	$0.00	$76.93
	06/01/2020	$49.83	$12.50	$15.70	$0.00	$78.03
	12/01/2020	$50.98	$12.50	$15.70	$0.00	$79.18
	06/01/2021	$52.08	$12.50	$15.70	$0.00	$80.28
	12/01/2021	$53.23	$12.50	$15.70	$0.00	$81.43
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
BACKHOE/FRONT-END LOADER *OPERATING ENGINEERS LOCAL 4*	12/01/2019	$48.73	$12.50	$15.70	$0.00	$76.93
	06/01/2020	$49.83	$12.50	$15.70	$0.00	$78.03
	12/01/2020	$50.98	$12.50	$15.70	$0.00	$79.18
	06/01/2021	$52.08	$12.50	$15.70	$0.00	$80.28
	12/01/2021	$53.23	$12.50	$15.70	$0.00	$81.43
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
BARCO-TYPE JUMPING TAMPER *LABORERS - ZONE 2*	12/01/2019	$34.31	$8.10	$15.38	$0.00	$57.79
	06/01/2020	$35.20	$8.10	$15.38	$0.00	$58.68
	12/01/2020	$36.09	$8.10	$15.38	$0.00	$59.57
	06/01/2021	$37.01	$8.10	$15.38	$0.00	$60.49
	12/01/2021	$37.92	$8.10	$15.38	$0.00	$61.40
For apprentice rates see "Apprentice- LABORER"						
BLOCK PAVER, RAMMER / CURB SETTER *LABORERS - ZONE 2*	12/01/2019	$34.81	$8.10	$15.38	$0.00	$58.29
	06/01/2020	$35.70	$8.10	$15.38	$0.00	$59.18
	12/01/2020	$36.59	$8.10	$15.38	$0.00	$60.07
	06/01/2021	$37.51	$8.10	$15.38	$0.00	$60.99
	12/01/2021	$38.42	$8.10	$15.38	$0.00	$61.90
For apprentice rates see "Apprentice- LABORER"						
BOILER MAKER *BOILERMAKERS LOCAL 29*	01/01/2020	$46.10	$7.07	$17.98	$0.00	$71.15

Apprentice - *BOILERMAKER - Local 29*

Effective Date - 01/01/2020

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	65	$29.97	$7.07	$11.69	$0.00	$48.73
2	65	$29.97	$7.07	$11.69	$0.00	$48.73
3	70	$32.27	$7.07	$12.59	$0.00	$51.93
4	75	$34.58	$7.07	$13.49	$0.00	$55.14
5	80	$36.88	$7.07	$14.38	$0.00	$58.33
6	85	$39.19	$7.07	$15.29	$0.00	$61.55
7	90	$41.49	$7.07	$16.18	$0.00	$64.74
8	95	$43.80	$7.07	$17.09	$0.00	$67.96

Notes:

Apprentice to Journeyworker Ratio:1:4

BRICK/STONE/ARTIFICIAL MASONRY (INCL. MASONRY WATERPROOFING) *BRICKLAYERS LOCAL 3 (LOWELL)*	08/01/2019	$52.26	$10.75	$20.70	$0.00	$83.71
	02/01/2020	$52.26	$10.75	$21.30	$0.00	$84.31
	08/01/2020	$53.61	$10.75	$21.45	$0.00	$85.81
	02/01/2021	$54.21	$10.75	$21.45	$0.00	$86.41
	08/01/2021	$55.61	$10.75	$21.61	$0.00	$87.97
	02/01/2022	$56.19	$10.75	$21.61	$0.00	$88.55

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *BRICK/PLASTER/CEMENT MASON - Local 3 Lowell*

Effective Date - 08/01/2019

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$26.13	$10.75	$20.70	$0.00	$57.58
2	60	$31.36	$10.75	$20.70	$0.00	$62.81
3	70	$36.58	$10.75	$20.70	$0.00	$68.03
4	80	$41.81	$10.75	$20.70	$0.00	$73.26
5	90	$47.03	$10.75	$20.70	$0.00	$78.48

Effective Date - 02/01/2020

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$26.13	$10.75	$21.30	$0.00	$58.18
2	60	$31.36	$10.75	$21.30	$0.00	$63.41
3	70	$36.58	$10.75	$21.30	$0.00	$68.63
4	80	$41.81	$10.75	$21.30	$0.00	$73.86
5	90	$47.03	$10.75	$21.30	$0.00	$79.08

Notes:

Apprentice to Journeyworker Ratio:1:5

BULLDOZER/GRADER/SCRAPER *OPERATING ENGINEERS LOCAL 4*	12/01/2019	$48.23	$12.50	$15.70	$0.00	$76.43
	06/01/2020	$49.31	$12.50	$15.70	$0.00	$77.51
	12/01/2020	$50.45	$12.50	$15.70	$0.00	$78.65
	06/01/2021	$51.54	$12.50	$15.70	$0.00	$79.74
	12/01/2021	$52.68	$12.50	$15.70	$0.00	$80.88
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
CAISSON & UNDERPINNING BOTTOM MAN *LABORERS - FOUNDATION AND MARINE*	12/01/2019	$40.25	$8.10	$16.80	$0.00	$65.15
	06/01/2020	$41.24	$8.10	$16.80	$0.00	$66.14
	12/01/2020	$42.22	$8.10	$16.80	$0.00	$67.12
	06/01/2021	$43.24	$8.10	$16.80	$0.00	$68.14
	12/01/2021	$44.25	$8.10	$16.80	$0.00	$69.15
For apprentice rates see "Apprentice- LABORER"						
CAISSON & UNDERPINNING LABORER *LABORERS - FOUNDATION AND MARINE*	12/01/2019	$39.10	$8.10	$16.80	$0.00	$64.00
	06/01/2020	$40.09	$8.10	$16.80	$0.00	$64.99
	12/01/2020	$41.07	$8.10	$16.80	$0.00	$65.97
	06/01/2021	$42.09	$8.10	$16.80	$0.00	$66.99
	12/01/2021	$43.10	$8.10	$16.80	$0.00	$68.00
For apprentice rates see "Apprentice- LABORER"						
CAISSON & UNDERPINNING TOP MAN *LABORERS - FOUNDATION AND MARINE*	12/01/2019	$39.10	$8.10	$16.80	$0.00	$64.00
	06/01/2020	$40.09	$8.10	$16.80	$0.00	$64.99
	12/01/2020	$41.07	$8.10	$16.80	$0.00	$65.97
	06/01/2021	$42.09	$8.10	$16.80	$0.00	$66.99
	12/01/2021	$43.10	$8.10	$16.80	$0.00	$68.00
For apprentice rates see "Apprentice- LABORER"						

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
CARBIDE CORE DRILL OPERATOR *LABORERS - ZONE 2*	12/01/2019	$34.31	$8.10	$15.38	$0.00	$57.79
	06/01/2020	$35.20	$8.10	$15.38	$0.00	$58.68
	12/01/2020	$36.09	$8.10	$15.38	$0.00	$59.57
	06/01/2021	$37.01	$8.10	$15.38	$0.00	$60.49
	12/01/2021	$37.92	$8.10	$15.38	$0.00	$61.40
For apprentice rates see "Apprentice- LABORER"						
CARPENTER *CARPENTERS -ZONE 2 (Eastern Massachusetts)*	09/01/2019	$41.90	$9.40	$18.95	$0.00	$70.25
	03/01/2020	$42.50	$9.40	$18.95	$0.00	$70.85
	09/01/2020	$43.15	$9.40	$18.95	$0.00	$71.50
	03/01/2021	$43.75	$9.40	$18.95	$0.00	$72.10
	09/01/2021	$44.40	$9.40	$18.95	$0.00	$72.75
	03/01/2022	$45.00	$9.40	$18.95	$0.00	$73.35
	09/01/2022	$45.65	$9.40	$18.95	$0.00	$74.00
	03/01/2023	$46.25	$9.40	$18.95	$0.00	$74.60

Apprentice - *CARPENTER - Zone 2 Eastern MA*

Effective Date - 09/01/2019

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$20.95	$9.40	$1.73	$0.00	$32.08
2	60	$25.14	$9.40	$1.73	$0.00	$36.27
3	70	$29.33	$9.40	$13.76	$0.00	$52.49
4	75	$31.43	$9.40	$13.76	$0.00	$54.59
5	80	$33.52	$9.40	$15.49	$0.00	$58.41
6	80	$33.52	$9.40	$15.49	$0.00	$58.41
7	90	$37.71	$9.40	$17.22	$0.00	$64.33
8	90	$37.71	$9.40	$17.22	$0.00	$64.33

Effective Date - 03/01/2020

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$21.25	$9.40	$1.73	$0.00	$32.38
2	60	$25.50	$9.40	$1.73	$0.00	$36.63
3	70	$29.75	$9.40	$13.76	$0.00	$52.91
4	75	$31.88	$9.40	$13.76	$0.00	$55.04
5	80	$34.00	$9.40	$15.49	$0.00	$58.89
6	80	$34.00	$9.40	$15.49	$0.00	$58.89
7	90	$38.25	$9.40	$17.22	$0.00	$64.87
8	90	$38.25	$9.40	$17.22	$0.00	$64.87

Notes:

% Indentured After 10/1/17; 45/45/55/55/70/70/80/80
Step 1&2 $29.99/ 3&4 $35.85/ 5&6 $54.22/ 7&8 $60.14

Apprentice to Journeyworker Ratio:1:5

CARPENTER WOOD FRAME *CARPENTERS -ZONE 2 (Wood Frame)*	10/01/2019	$27.95	$7.07	$7.86	$0.00	$42.88
All Aspects of New Wood Frame Work						

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *CARPENTER (Wood Frame) - Zone 2*

Effective Date - 10/01/2019

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	60	$16.77	$7.07	$0.00	$0.00	$23.84
2	60	$16.77	$7.07	$0.00	$0.00	$23.84
3	65	$18.17	$7.07	$7.86	$0.00	$33.10
4	70	$19.57	$7.07	$7.86	$0.00	$34.50
5	75	$20.96	$7.07	$7.86	$0.00	$35.89
6	80	$22.36	$7.07	$7.86	$0.00	$37.29
7	85	$23.76	$7.07	$7.86	$0.00	$38.69
8	90	$25.16	$7.07	$7.86	$0.00	$40.09

Notes:

% Indentured After 10/1/17; 45/45/55/55/70/70/80/80
Step 1&2 $19.65/ 3&4 $27.19/ 5&6 $34.50/ 7&8 $37.29

Apprentice to Journeyworker Ratio:1:5

CEMENT MASONRY/PLASTERING *BRICKLAYERS LOCAL 3 (LOWELL)*	01/01/2020	$45.23	$12.75	$22.41	$0.62	$81.01

Apprentice - *CEMENT MASONRY/PLASTERING - Lowell*

Effective Date - 01/01/2020

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$22.62	$12.75	$15.41	$0.00	$50.78
2	60	$27.14	$12.75	$17.41	$0.62	$57.92
3	65	$29.40	$12.75	$18.41	$0.62	$61.18
4	70	$31.66	$12.75	$19.41	$0.62	$64.44
5	75	$33.92	$12.75	$20.41	$0.62	$67.70
6	80	$36.18	$12.75	$21.41	$0.62	$70.96
7	90	$40.71	$12.75	$22.41	$0.62	$76.49

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*	12/01/2019	$34.31	$8.10	$15.38	$0.00	$57.79
	06/01/2020	$35.20	$8.10	$15.38	$0.00	$58.68
	12/01/2020	$36.09	$8.10	$15.38	$0.00	$59.57
	06/01/2021	$37.01	$8.10	$15.38	$0.00	$60.49
	12/01/2021	$37.92	$8.10	$15.38	$0.00	$61.40
For apprentice rates see "Apprentice- LABORER"						
CLAM SHELLS/SLURRY BUCKETS/HEADING MACHINES *OPERATING ENGINEERS LOCAL 4*	12/01/2019	$49.73	$12.50	$15.70	$0.00	$77.93
	06/01/2020	$50.83	$12.50	$15.70	$0.00	$79.03
	12/01/2020	$51.98	$12.50	$15.70	$0.00	$80.18
	06/01/2021	$53.08	$12.50	$15.70	$0.00	$81.28
	12/01/2021	$54.23	$12.50	$15.70	$0.00	$82.43

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
COMPRESSOR OPERATOR *OPERATING ENGINEERS LOCAL 4*	12/01/2019	$32.47	$12.50	$15.70	$0.00	$60.67
	06/01/2020	$33.22	$12.50	$15.70	$0.00	$61.42
	12/01/2020	$34.00	$12.50	$15.70	$0.00	$62.20
	06/01/2021	$34.75	$12.50	$15.70	$0.00	$62.95
	12/01/2021	$35.54	$12.50	$15.70	$0.00	$63.74
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
DELEADER (BRIDGE) *PAINTERS LOCAL 35 - ZONE 2*	01/01/2020	$50.96	$8.20	$22.10	$0.00	$81.26
	07/01/2020	$52.06	$8.20	$22.10	$0.00	$82.36
	01/01/2021	$53.16	$8.20	$22.10	$0.00	$83.46

Apprentice - *PAINTER Local 35 - BRIDGES/TANKS*

Effective Date - 01/01/2020

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$25.48	$8.20	$0.00	$0.00	$33.68
2	55	$28.03	$8.20	$5.94	$0.00	$42.17
3	60	$30.58	$8.20	$6.48	$0.00	$45.26
4	65	$33.12	$8.20	$7.02	$0.00	$48.34
5	70	$35.67	$8.20	$18.86	$0.00	$62.73
6	75	$38.22	$8.20	$19.40	$0.00	$65.82
7	80	$40.77	$8.20	$19.94	$0.00	$68.91
8	90	$45.86	$8.20	$21.02	$0.00	$75.08

Effective Date - 07/01/2020

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$26.03	$8.20	$0.00	$0.00	$34.23
2	55	$28.63	$8.20	$5.94	$0.00	$42.77
3	60	$31.24	$8.20	$6.48	$0.00	$45.92
4	65	$33.84	$8.20	$7.02	$0.00	$49.06
5	70	$36.44	$8.20	$18.86	$0.00	$63.50
6	75	$39.05	$8.20	$19.40	$0.00	$66.65
7	80	$41.65	$8.20	$19.94	$0.00	$69.79
8	90	$46.85	$8.20	$21.02	$0.00	$76.07

Notes:
Steps are 750 hrs.

Apprentice to Journeyworker Ratio:1:1

DEMO: ADZEMAN *LABORERS - ZONE 2*	12/01/2019	$39.30	$8.10	$16.60	$0.00	$64.00
For apprentice rates see "Apprentice- LABORER"						
DEMO: BACKHOE/LOADER/HAMMER OPERATOR *LABORERS - ZONE 2*	12/01/2019	$40.30	$8.10	$16.60	$0.00	$65.00
For apprentice rates see "Apprentice- LABORER"						
DEMO: BURNERS *LABORERS - ZONE 2*	12/01/2019	$40.05	$8.10	$16.60	$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 *LABORERS - ZONE 2*	12/01/2019	$40.30	$8.10	$16.60	$0.00	$65.00
For apprentice rates see "Apprentice- LABORER"						
DEMO: JACKHAMMER OPERATOR *LABORERS - ZONE 2*	12/01/2019	$40.05	$8.10	$16.60	$0.00	$64.75
For apprentice rates see "Apprentice- LABORER"						
DEMO: WRECKING LABORER *LABORERS - ZONE 2*	12/01/2019	$39.30	$8.10	$16.60	$0.00	$64.00
For apprentice rates see "Apprentice- LABORER"						
DIRECTIONAL DRILL MACHINE OPERATOR *OPERATING ENGINEERS LOCAL 4*	12/01/2019	$48.23	$12.50	$15.70	$0.00	$76.43
	06/01/2020	$49.31	$12.50	$15.70	$0.00	$77.51
	12/01/2020	$50.45	$12.50	$15.70	$0.00	$78.65
	06/01/2021	$51.54	$12.50	$15.70	$0.00	$79.74
	12/01/2021	$52.68	$12.50	$15.70	$0.00	$80.88
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
DIVER *PILE DRIVER LOCAL 56 (ZONE 1)*	08/01/2019	$68.52	$9.90	$21.15	$0.00	$99.57
For apprentice rates see "Apprentice- PILE DRIVER"						
DIVER TENDER *PILE DRIVER LOCAL 56 (ZONE 1)*	08/01/2019	$48.94	$9.90	$21.15	$0.00	$79.99
For apprentice rates see "Apprentice- PILE DRIVER"						
DIVER TENDER (EFFLUENT) *PILE DRIVER LOCAL 56 (ZONE 1)*	08/01/2019	$73.41	$9.90	$21.15	$0.00	$104.46
For apprentice rates see "Apprentice- PILE DRIVER"						
DIVER/SLURRY (EFFLUENT) *PILE DRIVER LOCAL 56 (ZONE 1)*	08/01/2019	$102.78	$9.90	$21.15	$0.00	$133.83
For apprentice rates see "Apprentice- PILE DRIVER"						
DRAWBRIDGE OPERATOR (Construction) *ELECTRICIANS LOCAL 103*	09/01/2019	$53.01	$13.00	$18.94	$0.00	$84.95
	03/01/2020	$53.50	$13.00	$19.20	$0.00	$85.70
	09/01/2020	$54.93	$13.00	$19.25	$0.00	$87.18
	03/01/2021	$56.13	$13.00	$19.28	$0.00	$88.41
	09/01/2021	$57.56	$13.00	$19.33	$0.00	$89.89
	03/01/2022	$58.76	$13.00	$19.36	$0.00	$91.12
	09/01/2022	$60.19	$13.00	$19.41	$0.00	$92.60
	03/01/2023	$61.39	$13.00	$19.44	$0.00	$93.83
For apprentice rates see "Apprentice- ELECTRICIAN"						
ELECTRICIAN *ELECTRICIANS LOCAL 103*	09/01/2019	$53.01	$13.00	$18.94	$0.00	$84.95
	03/01/2020	$53.50	$13.00	$19.20	$0.00	$85.70
	09/01/2020	$54.93	$13.00	$19.25	$0.00	$87.18
	03/01/2021	$56.13	$13.00	$19.28	$0.00	$88.41
	09/01/2021	$57.56	$13.00	$19.33	$0.00	$89.89
	03/01/2022	$58.76	$13.00	$19.36	$0.00	$91.12
	09/01/2022	$60.19	$13.00	$19.41	$0.00	$92.60
	03/01/2023	$61.39	$13.00	$19.44	$0.00	$93.83

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *ELECTRICIAN - Local 103*

Effective Date - 09/01/2019

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	40	$21.20	$13.00	$0.64	$0.00	$34.84
2	40	$21.20	$13.00	$0.64	$0.00	$34.84
3	45	$23.85	$13.00	$14.37	$0.00	$51.22
4	45	$23.85	$13.00	$14.37	$0.00	$51.22
5	50	$26.51	$13.00	$14.79	$0.00	$54.30
6	55	$29.16	$13.00	$15.20	$0.00	$57.36
7	60	$31.81	$13.00	$15.61	$0.00	$60.42
8	65	$34.46	$13.00	$16.03	$0.00	$63.49
9	70	$37.11	$13.00	$16.44	$0.00	$66.55
10	75	$39.76	$13.00	$16.86	$0.00	$69.62

Effective Date - 03/01/2020

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	40	$21.40	$13.00	$0.64	$0.00	$35.04
2	40	$21.40	$13.00	$0.64	$0.00	$35.04
3	45	$24.08	$13.00	$14.62	$0.00	$51.70
4	45	$24.08	$13.00	$14.62	$0.00	$51.70
5	50	$26.75	$13.00	$15.04	$0.00	$54.79
6	55	$29.43	$13.00	$15.46	$0.00	$57.89
7	60	$32.10	$13.00	$15.87	$0.00	$60.97
8	65	$34.78	$13.00	$16.29	$0.00	$64.07
9	70	$37.45	$13.00	$16.70	$0.00	$67.15
10	75	$40.13	$13.00	$17.12	$0.00	$70.25

Notes: :

App Prior 1/1/03; 30/35/40/45/50/55/65/70/75/80

Apprentice to Journeyworker Ratio:2:3***

ELEVATOR CONSTRUCTOR *ELEVATOR CONSTRUCTORS LOCAL 4*	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 - 01/01/2020

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$30.71	$15.73	$0.00	$0.00	$46.44
2	55	$33.78	$15.73	$18.41	$0.00	$67.92
3	65	$39.92	$15.73	$18.41	$0.00	$74.06
4	70	$42.99	$15.73	$18.41	$0.00	$77.13
5	80	$49.14	$15.73	$18.41	$0.00	$83.28

Effective Date - 01/01/2021

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$31.74	$15.88	$0.00	$0.00	$47.62
2	55	$34.91	$15.88	$19.31	$0.00	$70.10
3	65	$41.26	$15.88	$19.31	$0.00	$76.45
4	70	$44.43	$15.88	$19.31	$0.00	$79.62
5	80	$50.78	$15.88	$19.31	$0.00	$85.97

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*	01/01/2020	$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*	12/01/2019	$34.31	$8.10	$15.38	$0.00	$57.79
	06/01/2020	$35.20	$8.10	$15.38	$0.00	$58.68
	12/01/2020	$36.09	$8.10	$15.38	$0.00	$59.57
	06/01/2021	$37.01	$8.10	$15.38	$0.00	$60.49
	12/01/2021	$37.92	$8.10	$15.38	$0.00	$61.40
For apprentice rates see "Apprentice- LABORER"						
FIELD ENG.INST.PERSON-BLDG,SITE,HVY/HWY *OPERATING ENGINEERS LOCAL 4*	11/01/2019	$44.18	$12.00	$15.60	$0.00	$71.78
	05/01/2020	$45.33	$12.00	$15.60	$0.00	$72.93
	11/01/2020	$46.33	$12.00	$15.60	$0.00	$73.93
	05/01/2021	$47.48	$12.00	$15.60	$0.00	$75.08
	11/01/2021	$48.48	$12.00	$15.60	$0.00	$76.08
	05/01/2022	$49.63	$12.00	$15.60	$0.00	$77.23
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
FIELD ENG.PARTY CHIEF-BLDG,SITE,HVY/HWY *OPERATING ENGINEERS LOCAL 4*	11/01/2019	$45.68	$12.00	$15.60	$0.00	$73.28
	05/01/2020	$46.83	$12.00	$15.60	$0.00	$74.43
	11/01/2020	$47.84	$12.00	$15.60	$0.00	$75.44
	05/01/2021	$49.00	$12.00	$15.60	$0.00	$76.60
	11/01/2021	$50.01	$12.00	$15.60	$0.00	$77.61
	05/01/2022	$51.17	$12.00	$15.60	$0.00	$78.77
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
FIELD ENG.ROD PERSON-BLDG,SITE,HVY/HWY *OPERATING ENGINEERS LOCAL 4*	11/01/2019	$22.57	$12.00	$15.60	$0.00	$50.17
	05/01/2020	$23.24	$12.00	$15.60	$0.00	$50.84
	11/01/2020	$23.83	$12.00	$15.60	$0.00	$51.43
	05/01/2021	$24.51	$12.00	$15.60	$0.00	$52.11
	11/01/2021	$25.11	$12.00	$15.60	$0.00	$52.71
	05/01/2022	$25.78	$12.00	$15.60	$0.00	$53.38
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
FIRE ALARM INSTALLER *ELECTRICIANS LOCAL 103*	09/01/2019	$53.01	$13.00	$18.94	$0.00	$84.95
	03/01/2020	$53.50	$13.00	$19.20	$0.00	$85.70
	09/01/2020	$54.93	$13.00	$19.25	$0.00	$87.18
	03/01/2021	$56.13	$13.00	$19.28	$0.00	$88.41
	09/01/2021	$57.56	$13.00	$19.33	$0.00	$89.89
	03/01/2022	$58.76	$13.00	$19.36	$0.00	$91.12
	09/01/2022	$60.19	$13.00	$19.41	$0.00	$92.60
	03/01/2023	$61.39	$13.00	$19.44	$0.00	$93.83
For apprentice rates see "Apprentice- ELECTRICIAN"						
FIRE ALARM REPAIR / MAINTENANCE / COMMISSIONING*ELECTRICIANS* *LOCAL 103*	09/01/2019	$39.76	$13.00	$16.86	$0.00	$69.62
	03/01/2020	$40.13	$13.00	$17.12	$0.00	$70.25
	09/01/2020	$41.20	$13.00	$17.16	$0.00	$71.36
	03/01/2021	$42.66	$13.00	$17.27	$0.00	$72.93
	09/01/2021	$44.32	$13.00	$17.38	$0.00	$74.70
	03/01/2022	$45.83	$13.00	$17.49	$0.00	$76.32
	09/01/2022	$47.55	$13.00	$17.62	$0.00	$78.17
	03/01/2023	$49.11	$13.00	$17.73	$0.00	$79.84
For apprentice rates see "Apprentice- TELECOMMUNICATIONS TECHNICIAN"						
FIREMAN (ASST. ENGINEER) *OPERATING ENGINEERS LOCAL 4*	12/01/2019	$39.89	$12.50	$15.70	$0.00	$68.09
	06/01/2020	$40.80	$12.50	$15.70	$0.00	$69.00
	12/01/2020	$41.75	$12.50	$15.70	$0.00	$69.95
	06/01/2021	$42.66	$12.50	$15.70	$0.00	$70.86
	12/01/2021	$43.61	$12.50	$15.70	$0.00	$71.81
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
FLAGGER & SIGNALER *LABORERS - ZONE 2*	12/01/2019	$23.50	$8.10	$15.38	$0.00	$46.98
	06/01/2020	$23.50	$8.10	$15.38	$0.00	$46.98
	12/01/2020	$24.50	$8.10	$15.38	$0.00	$47.98
	06/01/2021	$24.50	$8.10	$15.38	$0.00	$47.98
	12/01/2021	$24.50	$8.10	$15.38	$0.00	$47.98
For apprentice rates see "Apprentice- LABORER"						
FLOORCOVERER *FLOORCOVERERS LOCAL 2168 ZONE I*	09/01/2019	$46.25	$9.40	$19.25	$0.00	$74.90
	03/01/2020	$47.05	$9.40	$19.25	$0.00	$75.70
	09/01/2020	$47.85	$9.40	$19.25	$0.00	$76.50
	03/01/2021	$48.65	$9.40	$19.25	$0.00	$77.30
	09/01/2021	$49.45	$9.40	$19.25	$0.00	$78.10
	03/01/2022	$50.25	$9.40	$19.25	$0.00	$78.90

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *FLOORCOVERER - Local 2168 Zone I*

Effective Date - 09/01/2019

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$23.13	$9.40	$1.79	$0.00	$34.32
2	55	$25.44	$9.40	$1.79	$0.00	$36.63
3	60	$27.75	$9.40	$13.88	$0.00	$51.03
4	65	$30.06	$9.40	$13.88	$0.00	$53.34
5	70	$32.38	$9.40	$15.67	$0.00	$57.45
6	75	$34.69	$9.40	$15.67	$0.00	$59.76
7	80	$37.00	$9.40	$17.46	$0.00	$63.86
8	85	$39.31	$9.40	$17.46	$0.00	$66.17

Effective Date - 03/01/2020

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$23.53	$9.40	$1.79	$0.00	$34.72
2	55	$25.88	$9.40	$1.79	$0.00	$37.07
3	60	$28.23	$9.40	$13.88	$0.00	$51.51
4	65	$30.58	$9.40	$13.88	$0.00	$53.86
5	70	$32.94	$9.40	$15.67	$0.00	$58.01
6	75	$35.29	$9.40	$15.67	$0.00	$60.36
7	80	$37.64	$9.40	$17.46	$0.00	$64.50
8	85	$39.99	$9.40	$17.46	$0.00	$66.85

Notes: Steps are 750 hrs.
% After 09/1/17; 45/45/55/55/70/70/80/80 (1500hr Steps)
Step 1&2 $32.00/ 3&4 $38.36/ 5&6 $57.45/ 7&8 $63.86

Apprentice to Journeyworker Ratio:1:1

FORK LIFT/CHERRY PICKER *OPERATING ENGINEERS LOCAL 4*	12/01/2019	$48.73	$12.50	$15.70	$0.00	$76.93
	06/01/2020	$49.83	$12.50	$15.70	$0.00	$78.03
	12/01/2020	$50.98	$12.50	$15.70	$0.00	$79.18
	06/01/2021	$52.08	$12.50	$15.70	$0.00	$80.28
	12/01/2021	$53.23	$12.50	$15.70	$0.00	$81.43
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
GENERATOR/LIGHTING PLANT/HEATERS *OPERATING ENGINEERS LOCAL 4*	12/01/2019	$32.47	$12.50	$15.70	$0.00	$60.67
	06/01/2020	$33.22	$12.50	$15.70	$0.00	$61.42
	12/01/2020	$34.00	$12.50	$15.70	$0.00	$62.20
	06/01/2021	$34.75	$12.50	$15.70	$0.00	$62.95
	12/01/2021	$35.54	$12.50	$15.70	$0.00	$63.74
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
GLAZIER (GLASS PLANK/AIR BARRIER/INTERIOR SYSTEMS) *GLAZIERS LOCAL 35 (ZONE 2)*	01/01/2020	$40.46	$8.20	$22.10	$0.00	$70.76
	07/01/2020	$41.56	$8.20	$22.10	$0.00	$71.86
	01/01/2021	$42.66	$8.20	$22.10	$0.00	$72.96

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *GLAZIER - Local 35 Zone 2*

Effective Date - 01/01/2020

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$20.23	$8.20	$0.00	$0.00	$28.43
2	55	$22.25	$8.20	$5.94	$0.00	$36.39
3	60	$24.28	$8.20	$6.48	$0.00	$38.96
4	65	$26.30	$8.20	$7.02	$0.00	$41.52
5	70	$28.32	$8.20	$18.86	$0.00	$55.38
6	75	$30.35	$8.20	$19.40	$0.00	$57.95
7	80	$32.37	$8.20	$19.94	$0.00	$60.51
8	90	$36.41	$8.20	$21.02	$0.00	$65.63

Effective Date - 07/01/2020

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$20.78	$8.20	$0.00	$0.00	$28.98
2	55	$22.86	$8.20	$5.94	$0.00	$37.00
3	60	$24.94	$8.20	$6.48	$0.00	$39.62
4	65	$27.01	$8.20	$7.02	$0.00	$42.23
5	70	$29.09	$8.20	$18.86	$0.00	$56.15
6	75	$31.17	$8.20	$19.40	$0.00	$58.77
7	80	$33.25	$8.20	$19.94	$0.00	$61.39
8	90	$37.40	$8.20	$21.02	$0.00	$66.62

Notes:
Steps are 750 hrs.

Apprentice to Journeyworker Ratio:1:1

HOISTING ENGINEER/CRANES/GRADALLS *OPERATING ENGINEERS LOCAL 4*	12/01/2019	$48.73	$12.50	$15.70	$0.00	$76.93
	06/01/2020	$49.83	$12.50	$15.70	$0.00	$78.03
	12/01/2020	$50.98	$12.50	$15.70	$0.00	$79.18
	06/01/2021	$52.08	$12.50	$15.70	$0.00	$80.28
	12/01/2021	$53.23	$12.50	$15.70	$0.00	$81.43

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *OPERATING ENGINEERS - Local 4*

Effective Date - 12/01/2019

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	55	$26.80	$12.50	$0.00	$0.00	$39.30
2	60	$29.24	$12.50	$15.70	$0.00	$57.44
3	65	$31.67	$12.50	$15.70	$0.00	$59.87
4	70	$34.11	$12.50	$15.70	$0.00	$62.31
5	75	$36.55	$12.50	$15.70	$0.00	$64.75
6	80	$38.98	$12.50	$15.70	$0.00	$67.18
7	85	$41.42	$12.50	$15.70	$0.00	$69.62
8	90	$43.86	$12.50	$15.70	$0.00	$72.06

Effective Date - 06/01/2020

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	55	$27.41	$12.50	$0.00	$0.00	$39.91
2	60	$29.90	$12.50	$15.70	$0.00	$58.10
3	65	$32.39	$12.50	$15.70	$0.00	$60.59
4	70	$34.88	$12.50	$15.70	$0.00	$63.08
5	75	$37.37	$12.50	$15.70	$0.00	$65.57
6	80	$39.86	$12.50	$15.70	$0.00	$68.06
7	85	$42.36	$12.50	$15.70	$0.00	$70.56
8	90	$44.85	$12.50	$15.70	$0.00	$73.05

Notes:

Apprentice to Journeyworker Ratio:1:6

HVAC (DUCTWORK) *SHEETMETAL WORKERS LOCAL 17 - A*	08/01/2019	$48.10	$13.20	$24.12	$2.56	$87.98
	02/01/2020	$49.36	$13.35	$24.12	$2.61	$89.44
	08/01/2020	$50.96	$13.35	$24.12	$2.66	$91.09
	02/01/2021	$52.61	$13.35	$24.12	$2.71	$92.79
	08/01/2021	$54.36	$13.35	$24.12	$2.76	$94.59
	02/01/2022	$56.11	$13.35	$24.12	$2.81	$96.39

For apprentice rates see "Apprentice- SHEET METAL WORKER"

HVAC (ELECTRICAL CONTROLS) *ELECTRICIANS LOCAL 103*	09/01/2019	$53.01	$13.00	$18.94	$0.00	$84.95
	03/01/2020	$53.50	$13.00	$19.20	$0.00	$85.70
	09/01/2020	$54.93	$13.00	$19.25	$0.00	$87.18
	03/01/2021	$56.13	$13.00	$19.28	$0.00	$88.41
	09/01/2021	$57.56	$13.00	$19.33	$0.00	$89.89
	03/01/2022	$58.76	$13.00	$19.36	$0.00	$91.12
	09/01/2022	$60.19	$13.00	$19.41	$0.00	$92.60
	03/01/2023	$61.39	$13.00	$19.44	$0.00	$93.83

For apprentice rates see "Apprentice- ELECTRICIAN"

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
HVAC (TESTING AND BALANCING - AIR) *SHEETMETAL WORKERS LOCAL 17 - A*	08/01/2019	$48.10	$13.20	$24.12	$2.56	$87.98
	02/01/2020	$49.36	$13.35	$24.12	$2.61	$89.44
	08/01/2020	$50.96	$13.35	$24.12	$2.66	$91.09
	02/01/2021	$52.61	$13.35	$24.12	$2.71	$92.79
	08/01/2021	$54.36	$13.35	$24.12	$2.76	$94.59
	02/01/2022	$56.11	$13.35	$24.12	$2.81	$96.39
For apprentice rates see "Apprentice- SHEET METAL WORKER"						
HVAC (TESTING AND BALANCING -WATER) *PIPEFITTERS LOCAL 537*	09/01/2019	$54.69	$10.95	$19.74	$0.00	$85.38
	03/01/2020	$56.19	$10.95	$19.74	$0.00	$86.88
	09/01/2020	$57.69	$10.95	$19.74	$0.00	$88.38
	03/01/2021	$59.19	$10.95	$19.74	$0.00	$89.88
For apprentice rates see "Apprentice- PIPEFITTER" or "PLUMBER/PIPEFITTER"						
HVAC MECHANIC *PIPEFITTERS LOCAL 537*	09/01/2019	$54.69	$10.95	$19.74	$0.00	$85.38
	03/01/2020	$56.19	$10.95	$19.74	$0.00	$86.88
	09/01/2020	$57.69	$10.95	$19.74	$0.00	$88.38
	03/01/2021	$59.19	$10.95	$19.74	$0.00	$89.88
For apprentice rates see "Apprentice- PIPEFITTER" or "PLUMBER/PIPEFITTER"						
HYDRAULIC DRILLS *LABORERS - ZONE 2*	12/01/2019	$34.81	$8.10	$15.38	$0.00	$58.29
	06/01/2020	$35.70	$8.10	$15.38	$0.00	$59.18
	12/01/2020	$36.59	$8.10	$15.38	$0.00	$60.07
	06/01/2021	$37.51	$8.10	$15.38	$0.00	$60.99
	12/01/2021	$38.42	$8.10	$15.38	$0.00	$61.90
For apprentice rates see "Apprentice- LABORER"						
INSULATOR (PIPES & TANKS) *HEAT & FROST INSULATORS LOCAL 6 (BOSTON)*	09/01/2019	$48.44	$12.80	$16.40	$0.00	$77.64

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

Effective Date - 09/01/2019

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$24.22	$12.80	$11.90	$0.00	$48.92
2	60	$29.06	$12.80	$12.80	$0.00	$54.66
3	70	$33.91	$12.80	$13.70	$0.00	$60.41
4	80	$38.75	$12.80	$14.60	$0.00	$66.15

Notes:
Steps are 1 year

Apprentice to Journeyworker Ratio:1:4

IRONWORKER/WELDER *IRONWORKERS LOCAL 7 (BOSTON AREA)*	03/16/2019	$46.66	$8.00	$23.50	$0.00	$78.16

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *IRONWORKER - Local 7 Boston*

Effective Date - 03/16/2019

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	60	$28.00	$8.00	$23.50	$0.00	$59.50
2	70	$32.66	$8.00	$23.50	$0.00	$64.16
3	75	$35.00	$8.00	$23.50	$0.00	$66.50
4	80	$37.33	$8.00	$23.50	$0.00	$68.83
5	85	$39.66	$8.00	$23.50	$0.00	$71.16
6	90	$41.99	$8.00	$23.50	$0.00	$73.49

Notes:

** Structural 1:6; Ornamental 1:4

Apprentice to Journeyworker Ratio:**

JACKHAMMER & PAVING BREAKER OPERATOR *LABORERS - ZONE 2*	12/01/2019	$34.31	$8.10	$15.38	$0.00	$57.79
	06/01/2020	$35.20	$8.10	$15.38	$0.00	$58.68
	12/01/2020	$36.09	$8.10	$15.38	$0.00	$59.57
	06/01/2021	$37.01	$8.10	$15.38	$0.00	$60.49
	12/01/2021	$37.92	$8.10	$15.38	$0.00	$61.40
For apprentice rates see "Apprentice- LABORER"						
LABORER *LABORERS - ZONE 2*	12/01/2019	$34.06	$8.10	$15.38	$0.00	$57.54
	06/01/2020	$34.95	$8.10	$15.38	$0.00	$58.43
	12/01/2020	$35.84	$8.10	$15.38	$0.00	$59.32
	06/01/2021	$36.76	$8.10	$15.38	$0.00	$60.24
	12/01/2021	$37.67	$8.10	$15.38	$0.00	$61.15

Apprentice - *LABORER - Zone 2*

Effective Date - 12/01/2019

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	60	$20.44	$8.10	$15.38	$0.00	$43.92
2	70	$23.84	$8.10	$15.38	$0.00	$47.32
3	80	$27.25	$8.10	$15.38	$0.00	$50.73
4	90	$30.65	$8.10	$15.38	$0.00	$54.13

Effective Date - 06/01/2020

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	60	$20.97	$8.10	$15.38	$0.00	$44.45
2	70	$24.47	$8.10	$15.38	$0.00	$47.95
3	80	$27.96	$8.10	$15.38	$0.00	$51.44
4	90	$31.46	$8.10	$15.38	$0.00	$54.94

Notes:

Apprentice to Journeyworker Ratio:1:5

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
LABORER: CARPENTER TENDER *LABORERS - ZONE 2*	12/01/2019	$34.06	$8.10	$15.38	$0.00	$57.54
	06/01/2020	$34.95	$8.10	$15.38	$0.00	$58.43
	12/01/2020	$35.84	$8.10	$15.38	$0.00	$59.32
	06/01/2021	$36.76	$8.10	$15.38	$0.00	$60.24
	12/01/2021	$37.67	$8.10	$15.38	$0.00	$61.15
For apprentice rates see "Apprentice- LABORER"						
LABORER: CEMENT FINISHER TENDER *LABORERS - ZONE 2*	12/01/2019	$34.06	$8.10	$15.38	$0.00	$57.54
	06/01/2020	$34.95	$8.10	$15.38	$0.00	$58.43
	12/01/2020	$35.84	$8.10	$15.38	$0.00	$59.32
	06/01/2021	$36.76	$8.10	$15.38	$0.00	$60.24
	12/01/2021	$37.67	$8.10	$15.38	$0.00	$61.15
For apprentice rates see "Apprentice- LABORER"						
LABORER: HAZARDOUS WASTE/ASBESTOS REMOVER *LABORERS - ZONE 2*	12/01/2019	$34.15	$8.10	$15.44	$0.00	$57.69
For apprentice rates see "Apprentice- LABORER"						
LABORER: MASON TENDER *LABORERS - ZONE 2*	12/01/2019	$34.31	$8.10	$15.38	$0.00	$57.79
	06/01/2020	$35.20	$8.10	$15.38	$0.00	$58.68
	12/01/2020	$36.09	$8.10	$15.38	$0.00	$59.57
	06/01/2021	$37.01	$8.10	$15.38	$0.00	$60.49
	12/01/2021	$37.92	$8.10	$15.38	$0.00	$61.40
For apprentice rates see "Apprentice- LABORER"						
LABORER: MULTI-TRADE TENDER *LABORERS - ZONE 2*	12/01/2019	$34.06	$8.10	$15.38	$0.00	$57.54
	06/01/2020	$34.95	$8.10	$15.38	$0.00	$58.43
	12/01/2020	$35.84	$8.10	$15.38	$0.00	$59.32
	06/01/2021	$36.76	$8.10	$15.38	$0.00	$60.24
	12/01/2021	$37.67	$8.10	$15.38	$0.00	$61.15
For apprentice rates see "Apprentice- LABORER"						
LABORER: TREE REMOVER *LABORERS - ZONE 2*	12/01/2019	$34.06	$8.10	$15.38	$0.00	$57.54
	06/01/2020	$34.95	$8.10	$15.38	$0.00	$58.43
	12/01/2020	$35.84	$8.10	$15.38	$0.00	$59.32
	06/01/2021	$36.76	$8.10	$15.38	$0.00	$60.24
	12/01/2021	$37.67	$8.10	$15.38	$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 *LABORERS - ZONE 2*	12/01/2019	$34.31	$8.10	$15.38	$0.00	$57.79
	06/01/2020	$35.20	$8.10	$15.38	$0.00	$58.68
	12/01/2020	$36.09	$8.10	$15.38	$0.00	$59.57
	06/01/2021	$37.01	$8.10	$15.38	$0.00	$60.49
	12/01/2021	$37.92	$8.10	$15.38	$0.00	$61.40
For apprentice rates see "Apprentice- LABORER"						
MARBLE & TILE FINISHERS *BRICKLAYERS LOCAL 3 - MARBLE & TILE*	08/01/2019	$41.49	$10.75	$19.61	$0.00	$71.85
	02/01/2020	$41.49	$10.75	$20.12	$0.00	$72.36
	08/01/2020	$42.57	$10.75	$20.27	$0.00	$73.59
	02/01/2021	$43.08	$10.75	$20.27	$0.00	$74.10
	08/01/2021	$44.20	$10.75	$20.43	$0.00	$75.38
	02/01/2022	$44.67	$10.75	$20.43	$0.00	$75.85

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

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

Effective Date - 08/01/2019

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$20.75	$10.75	$19.61	$0.00	$51.11
2	60	$24.89	$10.75	$19.61	$0.00	$55.25
3	70	$29.04	$10.75	$19.61	$0.00	$59.40
4	80	$33.19	$10.75	$19.61	$0.00	$63.55
5	90	$37.34	$10.75	$19.61	$0.00	$67.70

Effective Date - 02/01/2020

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$20.75	$10.75	$20.12	$0.00	$51.62
2	60	$24.89	$10.75	$20.12	$0.00	$55.76
3	70	$29.04	$10.75	$20.12	$0.00	$59.91
4	80	$33.19	$10.75	$20.12	$0.00	$64.06
5	90	$37.34	$10.75	$20.12	$0.00	$68.21

Notes:

Apprentice to Journeyworker Ratio:1:3

MARBLE MASONS,TILELAYERS & TERRAZZO MECH *BRICKLAYERS LOCAL 3 - MARBLE & TILE*	08/01/2019	$54.42	$10.75	$21.30	$0.00	$86.47
	02/01/2020	$54.42	$10.75	$21.93	$0.00	$87.10
	08/01/2020	$55.77	$10.75	$22.08	$0.00	$88.60
	02/01/2021	$56.41	$10.75	$22.08	$0.00	$89.24
	08/01/2021	$57.81	$10.75	$22.24	$0.00	$90.80
	02/01/2022	$58.38	$10.75	$22.24	$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 - 08/01/2019

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$27.21	$10.75	$21.30	$0.00	$59.26
2	60	$32.65	$10.75	$21.30	$0.00	$64.70
3	70	$38.09	$10.75	$21.30	$0.00	$70.14
4	80	$43.54	$10.75	$21.30	$0.00	$75.59
5	90	$48.98	$10.75	$21.30	$0.00	$81.03

Effective Date - 02/01/2020

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$27.21	$10.75	$21.93	$0.00	$59.89
2	60	$32.65	$10.75	$21.93	$0.00	$65.33
3	70	$38.09	$10.75	$21.93	$0.00	$70.77
4	80	$43.54	$10.75	$21.93	$0.00	$76.22
5	90	$48.98	$10.75	$21.93	$0.00	$81.66

Notes:

Apprentice to Journeyworker Ratio:1:5

MECH. SWEEPER OPERATOR (ON CONST. SITES) *OPERATING ENGINEERS LOCAL 4*	12/01/2019	$48.23	$12.50	$15.70	$0.00	$76.43
	06/01/2020	$49.31	$12.50	$15.70	$0.00	$77.51
	12/01/2020	$50.45	$12.50	$15.70	$0.00	$78.65
	06/01/2021	$51.54	$12.50	$15.70	$0.00	$79.74
	12/01/2021	$52.68	$12.50	$15.70	$0.00	$80.88
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
MECHANICS MAINTENANCE *OPERATING ENGINEERS LOCAL 4*	12/01/2019	$48.23	$12.50	$15.70	$0.00	$76.43
	06/01/2020	$49.31	$12.50	$15.70	$0.00	$77.51
	12/01/2020	$50.45	$12.50	$15.70	$0.00	$78.65
	06/01/2021	$51.54	$12.50	$15.70	$0.00	$79.74
	12/01/2021	$52.68	$12.50	$15.70	$0.00	$80.88
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
MILLWRIGHT (Zone 2) *MILLWRIGHTS LOCAL 1121 - Zone 2*	04/01/2019	$38.87	$9.90	$18.50	$0.00	$67.27

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *MILLWRIGHT - Local 1121 Zone 2*

Effective Date - 04/01/2019

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	55	$21.38	$9.90	$5.31	$0.00	$36.59
2	65	$25.27	$9.90	$15.13	$0.00	$50.30
3	75	$29.15	$9.90	$16.10	$0.00	$55.15
4	85	$33.04	$9.90	$17.06	$0.00	$60.00

Notes:

Steps are 2,000 hours

Apprentice to Journeyworker Ratio:1:5

MORTAR MIXER *LABORERS - ZONE 2*	12/01/2019	$34.31	$8.10	$15.38	$0.00	$57.79
	06/01/2020	$35.20	$8.10	$15.38	$0.00	$58.68
	12/01/2020	$36.09	$8.10	$15.38	$0.00	$59.57
	06/01/2021	$37.01	$8.10	$15.38	$0.00	$60.49
	12/01/2021	$37.92	$8.10	$15.38	$0.00	$61.40
For apprentice rates see "Apprentice- LABORER"						
OILER (OTHER THAN TRUCK CRANES,GRADALLS) *OPERATING ENGINEERS LOCAL 4*	12/01/2019	$23.08	$12.50	$15.70	$0.00	$51.28
	06/01/2020	$23.63	$12.50	$15.70	$0.00	$51.83
	12/01/2020	$24.20	$12.50	$15.70	$0.00	$52.40
	06/01/2021	$24.75	$12.50	$15.70	$0.00	$52.95
	12/01/2021	$25.33	$12.50	$15.70	$0.00	$53.53
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
OILER (TRUCK CRANES, GRADALLS) *OPERATING ENGINEERS LOCAL 4*	12/01/2019	$27.64	$12.50	$15.70	$0.00	$55.84
	06/01/2020	$28.29	$12.50	$15.70	$0.00	$56.49
	12/01/2020	$28.97	$12.50	$15.70	$0.00	$57.17
	06/01/2021	$29.61	$12.50	$15.70	$0.00	$57.81
	12/01/2021	$30.29	$12.50	$15.70	$0.00	$58.49
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
OTHER POWER DRIVEN EQUIPMENT - CLASS II *OPERATING ENGINEERS LOCAL 4*	12/01/2019	$48.23	$12.50	$15.70	$0.00	$76.43
	06/01/2020	$49.31	$12.50	$15.70	$0.00	$77.51
	12/01/2020	$50.45	$12.50	$15.70	$0.00	$78.65
	06/01/2021	$51.54	$12.50	$15.70	$0.00	$79.74
	12/01/2021	$52.68	$12.50	$15.70	$0.00	$80.88
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
PAINTER (BRIDGES/TANKS) *PAINTERS LOCAL 35 - ZONE 2*	01/01/2020	$50.96	$8.20	$22.10	$0.00	$81.26
	07/01/2020	$52.06	$8.20	$22.10	$0.00	$82.36
	01/01/2021	$53.16	$8.20	$22.10	$0.00	$83.46

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *PAINTER Local 35 - BRIDGES/TANKS*

Effective Date - 01/01/2020

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$25.48	$8.20	$0.00	$0.00	$33.68
2	55	$28.03	$8.20	$5.94	$0.00	$42.17
3	60	$30.58	$8.20	$6.48	$0.00	$45.26
4	65	$33.12	$8.20	$7.02	$0.00	$48.34
5	70	$35.67	$8.20	$18.86	$0.00	$62.73
6	75	$38.22	$8.20	$19.40	$0.00	$65.82
7	80	$40.77	$8.20	$19.94	$0.00	$68.91
8	90	$45.86	$8.20	$21.02	$0.00	$75.08

Effective Date - 07/01/2020

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$26.03	$8.20	$0.00	$0.00	$34.23
2	55	$28.63	$8.20	$5.94	$0.00	$42.77
3	60	$31.24	$8.20	$6.48	$0.00	$45.92
4	65	$33.84	$8.20	$7.02	$0.00	$49.06
5	70	$36.44	$8.20	$18.86	$0.00	$63.50
6	75	$39.05	$8.20	$19.40	$0.00	$66.65
7	80	$41.65	$8.20	$19.94	$0.00	$69.79
8	90	$46.85	$8.20	$21.02	$0.00	$76.07

Notes:
Steps are 750 hrs.

Apprentice to Journeyworker Ratio:1:1

PAINTER (SIGN, PICTORIAL & DISPLAY) *PAINTERS LOCAL 35 - ZONE 2*	06/01/2013	$25.81	$7.07	$7.05	$0.00	$39.93

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *PAINTER SIGN - 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

PAINTER (SPRAY OR SANDBLAST, NEW) *	01/01/2020	$41.86	$8.20	$22.10	$0.00	$72.16
* If 30% or more of surfaces to be painted are new construction, NEW paint rate shall be used.*PAINTERS LOCAL 35 - ZONE 2*	07/01/2020	$42.96	$8.20	$22.10	$0.00	$73.26
	01/01/2021	$44.06	$8.20	$22.10	$0.00	$74.36

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

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

Effective Date - 01/01/2020

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$20.93	$8.20	$0.00	$0.00	$29.13
2	55	$23.02	$8.20	$5.94	$0.00	$37.16
3	60	$25.12	$8.20	$6.48	$0.00	$39.80
4	65	$27.21	$8.20	$7.02	$0.00	$42.43
5	70	$29.30	$8.20	$18.86	$0.00	$56.36
6	75	$31.40	$8.20	$19.40	$0.00	$59.00
7	80	$33.49	$8.20	$19.94	$0.00	$61.63
8	90	$37.67	$8.20	$21.02	$0.00	$66.89

Effective Date - 07/01/2020

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$21.48	$8.20	$0.00	$0.00	$29.68
2	55	$23.63	$8.20	$5.94	$0.00	$37.77
3	60	$25.78	$8.20	$6.48	$0.00	$40.46
4	65	$27.92	$8.20	$7.02	$0.00	$43.14
5	70	$30.07	$8.20	$18.86	$0.00	$57.13
6	75	$32.22	$8.20	$19.40	$0.00	$59.82
7	80	$34.37	$8.20	$19.94	$0.00	$62.51
8	90	$38.66	$8.20	$21.02	$0.00	$67.88

Notes:
Steps are 750 hrs.

Apprentice to Journeyworker Ratio:1:1

PAINTER (SPRAY OR SANDBLAST, REPAINT) *PAINTERS LOCAL 35 - ZONE 2*	01/01/2020	$39.92	$8.20	$22.10	$0.00	$70.22
	07/01/2020	$41.02	$8.20	$22.10	$0.00	$71.32
	01/01/2021	$42.12	$8.20	$22.10	$0.00	$72.42

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

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

Effective Date - 01/01/2020

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$19.96	$8.20	$0.00	$0.00	$28.16
2	55	$21.96	$8.20	$5.94	$0.00	$36.10
3	60	$23.95	$8.20	$6.48	$0.00	$38.63
4	65	$25.95	$8.20	$7.02	$0.00	$41.17
5	70	$27.94	$8.20	$18.86	$0.00	$55.00
6	75	$29.94	$8.20	$19.40	$0.00	$57.54
7	80	$31.94	$8.20	$19.94	$0.00	$60.08
8	90	$35.93	$8.20	$21.02	$0.00	$65.15

Effective Date - 07/01/2020

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$20.51	$8.20	$0.00	$0.00	$28.71
2	55	$22.56	$8.20	$5.94	$0.00	$36.70
3	60	$24.61	$8.20	$6.48	$0.00	$39.29
4	65	$26.66	$8.20	$7.02	$0.00	$41.88
5	70	$28.71	$8.20	$18.86	$0.00	$55.77
6	75	$30.77	$8.20	$19.40	$0.00	$58.37
7	80	$32.82	$8.20	$19.94	$0.00	$60.96
8	90	$36.92	$8.20	$21.02	$0.00	$66.14

Notes:
Steps are 750 hrs.

Apprentice to Journeyworker Ratio:1:1

PAINTER (TRAFFIC MARKINGS) *LABORERS - ZONE 2*	12/01/2019	$34.06	$8.10	$15.38	$0.00	$57.54
	06/01/2020	$34.95	$8.10	$15.38	$0.00	$58.43
	12/01/2020	$35.84	$8.10	$15.38	$0.00	$59.32
	06/01/2021	$36.76	$8.10	$15.38	$0.00	$60.24
	12/01/2021	$37.67	$8.10	$15.38	$0.00	$61.15
For Apprentice rates see "Apprentice- LABORER"						
PAINTER / TAPER (BRUSH, NEW) * * If 30% or more of surfaces to be painted are new construction, NEW paint rate shall be used.*PAINTERS LOCAL 35 - ZONE 2*	01/01/2020	$40.46	$8.20	$22.10	$0.00	$70.76
	07/01/2020	$41.56	$8.20	$22.10	$0.00	$71.86
	01/01/2021	$42.66	$8.20	$22.10	$0.00	$72.96

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *PAINTER - Local 35 Zone 2 - BRUSH NEW*

Effective Date - 01/01/2020

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$20.23	$8.20	$0.00	$0.00	$28.43
2	55	$22.25	$8.20	$5.94	$0.00	$36.39
3	60	$24.28	$8.20	$6.48	$0.00	$38.96
4	65	$26.30	$8.20	$7.02	$0.00	$41.52
5	70	$28.32	$8.20	$18.86	$0.00	$55.38
6	75	$30.35	$8.20	$19.40	$0.00	$57.95
7	80	$32.37	$8.20	$19.94	$0.00	$60.51
8	90	$36.41	$8.20	$21.02	$0.00	$65.63

Effective Date - 07/01/2020

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$20.78	$8.20	$0.00	$0.00	$28.98
2	55	$22.86	$8.20	$5.94	$0.00	$37.00
3	60	$24.94	$8.20	$6.48	$0.00	$39.62
4	65	$27.01	$8.20	$7.02	$0.00	$42.23
5	70	$29.09	$8.20	$18.86	$0.00	$56.15
6	75	$31.17	$8.20	$19.40	$0.00	$58.77
7	80	$33.25	$8.20	$19.94	$0.00	$61.39
8	90	$37.40	$8.20	$21.02	$0.00	$66.62

Notes:
Steps are 750 hrs.

Apprentice to Journeyworker Ratio:1:1

PAINTER / TAPER (BRUSH, REPAINT) *PAINTERS LOCAL 35 - ZONE 2*	01/01/2020	$38.52	$8.20	$22.10	$0.00	$68.82
	07/01/2020	$39.62	$8.20	$22.10	$0.00	$69.92
	01/01/2021	$40.72	$8.20	$22.10	$0.00	$71.02

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *PAINTER Local 35 Zone 2 - BRUSH REPAINT*

Effective Date - 01/01/2020

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$19.26	$8.20	$0.00	$0.00	$27.46
2	55	$21.19	$8.20	$5.94	$0.00	$35.33
3	60	$23.11	$8.20	$6.48	$0.00	$37.79
4	65	$25.04	$8.20	$7.02	$0.00	$40.26
5	70	$26.96	$8.20	$18.86	$0.00	$54.02
6	75	$28.89	$8.20	$19.40	$0.00	$56.49
7	80	$30.82	$8.20	$19.94	$0.00	$58.96
8	90	$34.67	$8.20	$21.02	$0.00	$63.89

Effective Date - 07/01/2020

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$19.81	$8.20	$0.00	$0.00	$28.01
2	55	$21.79	$8.20	$5.94	$0.00	$35.93
3	60	$23.77	$8.20	$6.48	$0.00	$38.45
4	65	$25.75	$8.20	$7.02	$0.00	$40.97
5	70	$27.73	$8.20	$18.86	$0.00	$54.79
6	75	$29.72	$8.20	$19.40	$0.00	$57.32
7	80	$31.70	$8.20	$19.94	$0.00	$59.84
8	90	$35.66	$8.20	$21.02	$0.00	$64.88

Notes:
Steps are 750 hrs.

Apprentice to Journeyworker Ratio:1:1

PANEL & PICKUP TRUCKS DRIVER *TEAMSTERS JOINT COUNCIL NO. 10 ZONE B*	12/01/2019	$34.08	$12.41	$13.72	$0.00	$60.21
	06/01/2020	$34.98	$12.41	$13.72	$0.00	$61.11
	08/01/2020	$34.98	$12.91	$13.72	$0.00	$61.61
	12/01/2020	$34.98	$12.91	$14.82	$0.00	$62.71
	06/01/2021	$35.78	$12.91	$14.82	$0.00	$63.51
	08/01/2021	$35.78	$13.41	$14.82	$0.00	$64.01
	12/01/2021	$35.78	$13.41	$16.01	$0.00	$65.20
PIER AND DOCK CONSTRUCTOR (UNDERPINNING AND DECK) *PILE DRIVER LOCAL 56 (ZONE 1)* For apprentice rates see "Apprentice- PILE DRIVER"	08/01/2019	$48.94	$9.90	$21.15	$0.00	$79.99
PILE DRIVER *PILE DRIVER LOCAL 56 (ZONE 1)*	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 - 08/01/2019

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$24.47	$9.90	$21.15	$0.00	$55.52
2	60	$29.36	$9.90	$21.15	$0.00	$60.41
3	70	$34.26	$9.90	$21.15	$0.00	$65.31
4	75	$36.71	$9.90	$21.15	$0.00	$67.76
5	80	$39.15	$9.90	$21.15	$0.00	$70.20
6	80	$39.15	$9.90	$21.15	$0.00	$70.20
7	90	$44.05	$9.90	$21.15	$0.00	$75.10
8	90	$44.05	$9.90	$21.15	$0.00	$75.10

Notes:

Apprentice to Journeyworker Ratio:1:5

PIPEFITTER & STEAMFITTER *PIPEFITTERS LOCAL 537*	09/01/2019	$54.69	$10.95	$19.74	$0.00	$85.38
	03/01/2020	$56.19	$10.95	$19.74	$0.00	$86.88
	09/01/2020	$57.69	$10.95	$19.74	$0.00	$88.38
	03/01/2021	$59.19	$10.95	$19.74	$0.00	$89.88

Apprentice - *PIPEFITTER - Local 537*

Effective Date - 09/01/2019

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	40	$21.88	$10.95	$8.00	$0.00	$40.83
2	45	$24.61	$10.95	$19.74	$0.00	$55.30
3	60	$32.81	$10.95	$19.74	$0.00	$63.50
4	70	$38.28	$10.95	$19.74	$0.00	$68.97
5	80	$43.75	$10.95	$19.74	$0.00	$74.44

Effective Date - 03/01/2020

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	40	$22.48	$10.95	$8.00	$0.00	$41.43
2	45	$25.29	$10.95	$19.74	$0.00	$55.98
3	60	$33.71	$10.95	$19.74	$0.00	$64.40
4	70	$39.33	$10.95	$19.74	$0.00	$70.02
5	80	$44.95	$10.95	$19.74	$0.00	$75.64

Notes:

** 1:3; 3:15; 1:10 thereafter / Steps are 1 yr.

Refrig/AC Mechanic **1:1;1:2;2:4;3:6;4:8;5:10;6:12;7:14;8:17;9:20;10:23(Max)

Apprentice to Journeyworker Ratio:**

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
PIPELAYER *LABORERS - ZONE 2*	12/01/2019	$34.31	$8.10	$15.38	$0.00	$57.79
	06/01/2020	$35.20	$8.10	$15.38	$0.00	$58.68
	12/01/2020	$36.09	$8.10	$15.38	$0.00	$59.57
	06/01/2021	$37.01	$8.10	$15.38	$0.00	$60.49
	12/01/2021	$37.92	$8.10	$15.38	$0.00	$61.40
For apprentice rates see "Apprentice- LABORER"						
PLUMBERS & GASFITTERS *PLUMBERS & GASFITTERS LOCAL 12*	09/01/2019	$57.69	$11.82	$17.01	$0.00	$86.52
	03/01/2020	$59.19	$11.82	$17.01	$0.00	$88.02
	09/01/2020	$60.69	$11.82	$17.01	$0.00	$89.52
	03/01/2021	$62.19	$11.82	$17.01	$0.00	$91.02

Apprentice - *PLUMBER/GASFITTER - Local 12*

Effective Date - 09/01/2019

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	35	$20.19	$11.82	$6.16	$0.00	$38.17
2	40	$23.08	$11.82	$6.99	$0.00	$41.89
3	55	$31.73	$11.82	$9.53	$0.00	$53.08
4	65	$37.50	$11.82	$11.18	$0.00	$60.50
5	75	$43.27	$11.82	$12.88	$0.00	$67.97

Effective Date - 03/01/2020

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	35	$20.72	$11.82	$6.16	$0.00	$38.70
2	40	$23.68	$11.82	$6.99	$0.00	$42.49
3	55	$32.55	$11.82	$9.53	$0.00	$53.90
4	65	$38.47	$11.82	$11.18	$0.00	$61.47
5	75	$44.39	$11.82	$12.88	$0.00	$69.09

Notes:

** 1:2; 2:6; 3:10; 4:14; 5:19/Steps are 1 yr
Step4 with lic$64.20, Step5 with lic$71.67

Apprentice to Journeyworker Ratio:**

PNEUMATIC CONTROLS (TEMP.) *PIPEFITTERS LOCAL 537*	09/01/2019	$54.69	$10.95	$19.74	$0.00	$85.38
	03/01/2020	$56.19	$10.95	$19.74	$0.00	$86.88
	09/01/2020	$57.69	$10.95	$19.74	$0.00	$88.38
	03/01/2021	$59.17	$10.95	$19.74	$0.00	$89.86
For apprentice rates see "Apprentice- PIPEFITTER" or "PLUMBER/PIPEFITTER"						
PNEUMATIC DRILL/TOOL OPERATOR *LABORERS - ZONE 2*	12/01/2019	$34.31	$8.10	$15.38	$0.00	$57.79
	06/01/2020	$35.20	$8.10	$15.38	$0.00	$58.68
	12/01/2020	$36.09	$8.10	$15.38	$0.00	$59.57
	06/01/2021	$37.01	$8.10	$15.38	$0.00	$60.49
	12/01/2021	$37.92	$8.10	$15.38	$0.00	$61.40
For apprentice rates see "Apprentice- LABORER"						

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
POWDERMAN & BLASTER *LABORERS - ZONE 2*	12/01/2019	$35.06	$8.10	$15.38	$0.00	$58.54
	06/01/2020	$35.95	$8.10	$15.38	$0.00	$59.43
	12/01/2020	$36.84	$8.10	$15.38	$0.00	$60.32
	06/01/2021	$37.76	$8.10	$15.38	$0.00	$61.24
	12/01/2021	$38.67	$8.10	$15.38	$0.00	$62.15
For apprentice rates see "Apprentice- LABORER"						
POWER SHOVEL/DERRICK/TRENCHING MACHINE *OPERATING ENGINEERS LOCAL 4*	12/01/2019	$48.73	$12.50	$15.70	$0.00	$76.93
	06/01/2020	$49.83	$12.50	$15.70	$0.00	$78.03
	12/01/2020	$50.98	$12.50	$15.70	$0.00	$79.18
	06/01/2021	$52.08	$12.50	$15.70	$0.00	$80.28
	12/01/2021	$53.23	$12.50	$15.70	$0.00	$81.43
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
PUMP OPERATOR (CONCRETE) *OPERATING ENGINEERS LOCAL 4*	12/01/2019	$48.73	$12.50	$15.70	$0.00	$76.93
	06/01/2020	$49.83	$12.50	$15.70	$0.00	$78.03
	12/01/2020	$50.98	$12.50	$15.70	$0.00	$79.18
	06/01/2021	$52.08	$12.50	$15.70	$0.00	$80.28
	12/01/2021	$53.23	$12.50	$15.70	$0.00	$81.43
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
PUMP OPERATOR (DEWATERING, OTHER) *OPERATING ENGINEERS LOCAL 4*	12/01/2019	$32.47	$12.50	$15.70	$0.00	$60.67
	06/01/2020	$33.22	$12.50	$15.70	$0.00	$61.42
	12/01/2020	$34.00	$12.50	$15.70	$0.00	$62.20
	06/01/2021	$34.75	$12.50	$15.70	$0.00	$62.95
	12/01/2021	$35.54	$12.50	$15.70	$0.00	$63.74
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
READY-MIX CONCRETE DRIVER *TEAMSTERS 170 - Dauphinais (Bellingham)*	01/01/2020	$24.00	$11.01	$2.50	$0.00	$37.51
RECLAIMERS *OPERATING ENGINEERS LOCAL 4*	12/01/2019	$48.23	$12.50	$15.70	$0.00	$76.43
	06/01/2020	$49.31	$12.50	$15.70	$0.00	$77.51
	12/01/2020	$50.45	$12.50	$15.70	$0.00	$78.65
	06/01/2021	$51.54	$12.50	$15.70	$0.00	$79.74
	12/01/2021	$52.68	$12.50	$15.70	$0.00	$80.88
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
RIDE-ON MOTORIZED BUGGY OPERATOR *LABORERS - ZONE 2*	12/01/2019	$34.31	$8.10	$15.38	$0.00	$57.79
	06/01/2020	$35.20	$8.10	$15.38	$0.00	$58.68
	12/01/2020	$36.09	$8.10	$15.38	$0.00	$59.57
	06/01/2021	$37.01	$8.10	$15.38	$0.00	$60.49
	12/01/2021	$37.92	$8.10	$15.38	$0.00	$61.40
For apprentice rates see "Apprentice- LABORER"						
ROLLER/SPREADER/MULCHING MACHINE *OPERATING ENGINEERS LOCAL 4*	12/01/2019	$48.23	$12.50	$15.70	$0.00	$76.43
	06/01/2020	$49.31	$12.50	$15.70	$0.00	$77.51
	12/01/2020	$50.45	$12.50	$15.70	$0.00	$78.65
	06/01/2021	$51.54	$12.50	$15.70	$0.00	$79.74
	12/01/2021	$52.68	$12.50	$15.70	$0.00	$80.88
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
ROOFER (Inc.Roofer Waterproofng &Roofer Damproofg) *ROOFERS LOCAL 33*	08/01/2019	$44.64	$11.50	$15.90	$0.00	$72.04
	02/01/2020	$45.92	$11.50	$15.90	$0.00	$73.32
	08/01/2020	$47.35	$11.50	$15.90	$0.00	$74.75
	02/01/2021	$48.78	$11.50	$15.90	$0.00	$76.18
	08/01/2021	$50.21	$11.50	$15.90	$0.00	$77.61
	02/01/2022	$51.64	$11.50	$15.90	$0.00	$79.04

Apprentice - *ROOFER - Local 33*

Effective Date - 08/01/2019

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$22.32	$11.50	$3.69	$0.00	$37.51
2	60	$26.78	$11.50	$15.90	$0.00	$54.18
3	65	$29.02	$11.50	$15.90	$0.00	$56.42
4	75	$33.48	$11.50	$15.90	$0.00	$60.88
5	85	$37.94	$11.50	$15.90	$0.00	$65.34

Effective Date - 02/01/2020

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$22.96	$11.50	$3.69	$0.00	$38.15
2	60	$27.55	$11.50	$15.90	$0.00	$54.95
3	65	$29.85	$11.50	$15.90	$0.00	$57.25
4	75	$34.44	$11.50	$15.90	$0.00	$61.84
5	85	$39.03	$11.50	$15.90	$0.00	$66.43

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:**

ROOFER SLATE / TILE / PRECAST CONCRETE *ROOFERS LOCAL 33*	08/01/2019	$44.89	$11.50	$15.90	$0.00	$72.29
	02/01/2020	$46.17	$11.50	$15.90	$0.00	$73.57
	08/01/2020	$47.60	$11.50	$15.90	$0.00	$75.00
	02/01/2021	$49.03	$11.50	$15.90	$0.00	$76.43
	08/01/2021	$50.46	$11.50	$15.90	$0.00	$77.86
	02/01/2022	$51.89	$11.50	$15.90	$0.00	$79.29
For apprentice rates see "Apprentice- ROOFER"						
SHEETMETAL WORKER *SHEETMETAL WORKERS LOCAL 17 - A*	08/01/2019	$48.10	$13.20	$24.12	$2.56	$87.98
	02/01/2020	$49.36	$13.35	$24.12	$2.61	$89.44
	08/01/2020	$50.96	$13.35	$24.12	$2.66	$91.09
	02/01/2021	$52.61	$13.35	$24.12	$2.71	$92.79
	08/01/2021	$54.36	$13.35	$24.12	$2.76	$94.59
	02/01/2022	$56.11	$13.35	$24.12	$2.81	$96.39

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *SHEET METAL WORKER - Local 17-A*

Effective Date - 08/01/2019

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	42	$20.20	$13.20	$5.89	$0.00	$39.29
2	42	$20.20	$13.20	$5.89	$0.00	$39.29
3	47	$22.61	$13.20	$11.13	$1.41	$48.35
4	47	$22.61	$13.20	$11.13	$1.41	$48.35
5	52	$25.01	$13.20	$12.08	$1.51	$51.80
6	52	$25.01	$13.20	$12.33	$1.52	$52.06
7	60	$28.86	$13.20	$13.70	$1.67	$57.43
8	65	$31.27	$13.20	$14.65	$1.77	$60.89
9	75	$36.08	$13.20	$16.56	$1.98	$67.82
10	85	$40.89	$13.20	$17.96	$2.16	$74.21

Effective Date - 02/01/2020

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	42	$20.73	$13.35	$5.89	$0.00	$39.97
2	42	$20.73	$13.35	$5.89	$0.00	$39.97
3	47	$23.20	$13.35	$11.13	$1.43	$49.11
4	47	$23.20	$13.35	$11.13	$1.43	$49.11
5	52	$25.67	$13.35	$12.08	$1.53	$52.63
6	52	$25.67	$13.35	$12.33	$1.54	$52.89
7	60	$29.62	$13.35	$13.70	$1.70	$58.37
8	65	$32.08	$13.35	$14.65	$1.80	$61.88
9	75	$37.02	$13.35	$16.56	$2.01	$68.94
10	85	$41.96	$13.35	$17.96	$2.20	$75.47

Notes:
Steps are 6 mos.

Apprentice to Journeyworker Ratio:1:4

SPECIALIZED EARTH MOVING EQUIP < 35 TONS *TEAMSTERS JOINT COUNCIL NO. 10 ZONE B*	12/01/2019	$34.54	$12.41	$13.72	$0.00	$60.67
	06/01/2020	$35.44	$12.41	$13.72	$0.00	$61.57
	08/01/2020	$35.44	$12.91	$13.72	$0.00	$62.07
	12/01/2020	$35.44	$12.91	$14.82	$0.00	$63.17
	06/01/2021	$36.24	$12.91	$14.82	$0.00	$63.97
	08/01/2021	$36.24	$13.41	$14.82	$0.00	$64.47
	12/01/2021	$36.24	$13.41	$16.01	$0.00	$65.66

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
SPECIALIZED EARTH MOVING EQUIP > 35 TONS *TEAMSTERS JOINT COUNCIL NO. 10 ZONE B*	12/01/2019	$34.83	$12.41	$13.72	$0.00	$60.96
	06/01/2020	$35.73	$12.41	$13.72	$0.00	$61.86
	08/01/2020	$35.73	$12.91	$13.72	$0.00	$62.36
	12/01/2020	$35.73	$12.91	$14.82	$0.00	$63.46
	06/01/2021	$36.53	$12.91	$14.82	$0.00	$64.26
	08/01/2021	$36.53	$13.41	$14.82	$0.00	$64.76
	12/01/2021	$36.53	$13.41	$16.01	$0.00	$65.95
SPRINKLER FITTER *SPRINKLER FITTERS LOCAL 550 - (Section A) Zone 1*	01/01/2020	$60.07	$9.68	$19.80	$0.00	$89.55
	03/01/2020	$61.98	$9.47	$19.60	$0.00	$91.05
	10/01/2020	$63.48	$9.47	$19.60	$0.00	$92.55
	03/01/2021	$64.98	$9.47	$19.60	$0.00	$94.05

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

Effective Date - 01/01/2020

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	35	$21.02	$9.68	$11.35	$0.00	$42.05
2	40	$24.03	$9.68	$12.00	$0.00	$45.71
3	45	$27.03	$9.68	$12.65	$0.00	$49.36
4	50	$30.04	$9.68	$13.30	$0.00	$53.02
5	55	$33.04	$9.68	$13.95	$0.00	$56.67
6	60	$36.04	$9.68	$14.60	$0.00	$60.32
7	65	$39.05	$9.68	$15.25	$0.00	$63.98
8	70	$42.05	$9.68	$15.90	$0.00	$67.63
9	75	$45.05	$9.68	$16.55	$0.00	$71.28
10	80	$48.06	$9.68	$17.20	$0.00	$74.94

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 *OPERATING ENGINEERS LOCAL 4*	12/01/2019	$48.23	$12.50	$15.70	$0.00	$76.43
	06/01/2020	$49.31	$12.50	$15.70	$0.00	$77.51
	12/01/2020	$50.45	$12.50	$15.70	$0.00	$78.65
	06/01/2021	$51.54	$12.50	$15.70	$0.00	$79.74
	12/01/2021	$52.68	$12.50	$15.70	$0.00	$80.88
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
TAMPERS, SELF-PROPELLED OR TRACTOR DRAWN *OPERATING ENGINEERS LOCAL 4*	12/01/2019	$48.23	$12.50	$15.70	$0.00	$76.43
	06/01/2020	$49.31	$12.50	$15.70	$0.00	$77.51
	12/01/2020	$50.45	$12.50	$15.70	$0.00	$78.65
	06/01/2021	$51.54	$12.50	$15.70	$0.00	$79.74
	12/01/2021	$52.68	$12.50	$15.70	$0.00	$80.88
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
TELECOMMUNICATION TECHNICIAN *ELECTRICIANS LOCAL 103*	09/01/2019	$39.76	$13.00	$16.86	$0.00	$69.62
	03/01/2020	$40.13	$13.00	$17.12	$0.00	$70.25
	09/01/2020	$41.20	$13.00	$17.16	$0.00	$71.36
	03/01/2021	$42.66	$13.00	$17.27	$0.00	$72.93
	09/01/2021	$44.32	$13.00	$17.38	$0.00	$74.70
	03/01/2022	$45.83	$13.00	$17.49	$0.00	$76.32
	09/01/2022	$47.55	$13.00	$17.62	$0.00	$78.17
	03/01/2023	$49.11	$13.00	$17.73	$0.00	$79.84

Apprentice - *TELECOMMUNICATION TECHNICIAN - Local 103*

Effective Date - 09/01/2019

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	45	$17.89	$13.00	$0.54	$0.00	$31.43
2	45	$17.89	$13.00	$0.54	$0.00	$31.43
3	50	$19.88	$13.00	$13.75	$0.00	$46.63
4	50	$19.88	$13.00	$13.75	$0.00	$46.63
5	55	$21.87	$13.00	$14.06	$0.00	$48.93
6	60	$23.86	$13.00	$14.37	$0.00	$51.23
7	65	$25.84	$13.00	$14.69	$0.00	$53.53
8	70	$27.83	$13.00	$14.99	$0.00	$55.82
9	75	$29.82	$13.00	$15.30	$0.00	$58.12
10	80	$31.81	$13.00	$15.61	$0.00	$60.42

Effective Date - 03/01/2020

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	45	$18.06	$13.00	$0.54	$0.00	$31.60
2	45	$18.06	$13.00	$0.54	$0.00	$31.60
3	50	$20.07	$13.00	$14.00	$0.00	$47.07
4	50	$20.07	$13.00	$14.00	$0.00	$47.07
5	55	$22.07	$13.00	$14.31	$0.00	$49.38
6	60	$24.08	$13.00	$14.62	$0.00	$51.70
7	65	$26.08	$13.00	$14.94	$0.00	$54.02
8	70	$28.09	$13.00	$15.26	$0.00	$56.35
9	75	$30.10	$13.00	$15.56	$0.00	$58.66
10	80	$32.10	$13.00	$15.87	$0.00	$60.97

Notes:

Apprentice to Journeyworker Ratio:1:1

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
TERRAZZO FINISHERS *BRICKLAYERS LOCAL 3 - MARBLE & TILE*	08/01/2019	$53.34	$10.75	$21.30	$0.00	$85.39
	02/01/2020	$53.34	$10.75	$21.94	$0.00	$86.03
	08/01/2020	$54.69	$10.75	$22.09	$0.00	$87.53
	02/01/2021	$55.33	$10.75	$22.09	$0.00	$88.17
	08/01/2021	$56.73	$10.75	$22.25	$0.00	$89.73
	02/01/2022	$57.32	$10.75	$22.25	$0.00	$90.32

Apprentice - *TERRAZZO FINISHER - Local 3 Marble & Tile*

Effective Date - 08/01/2019

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$26.67	$10.75	$21.30	$0.00	$58.72
2	60	$32.00	$10.75	$21.30	$0.00	$64.05
3	70	$37.34	$10.75	$21.30	$0.00	$69.39
4	80	$42.67	$10.75	$21.30	$0.00	$74.72
5	90	$48.01	$10.75	$21.30	$0.00	$80.06

Effective Date - 02/01/2020

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	$26.67	$10.75	$21.94	$0.00	$59.36
2	60	$32.00	$10.75	$21.94	$0.00	$64.69
3	70	$37.34	$10.75	$21.94	$0.00	$70.03
4	80	$42.67	$10.75	$21.94	$0.00	$75.36
5	90	$48.01	$10.75	$21.94	$0.00	$80.70

Notes:

Apprentice to Journeyworker Ratio:1:3

TEST BORING DRILLER *LABORERS - FOUNDATION AND MARINE*	12/01/2019	$40.50	$8.10	$16.80	$0.00	$65.40
	06/01/2020	$41.49	$8.10	$16.80	$0.00	$66.39
	12/01/2020	$42.47	$8.10	$16.80	$0.00	$67.37
	06/01/2021	$43.49	$8.10	$16.80	$0.00	$68.39
	12/01/2021	$44.50	$8.10	$16.80	$0.00	$69.40
For apprentice rates see "Apprentice- LABORER"						
TEST BORING DRILLER HELPER *LABORERS - FOUNDATION AND MARINE*	12/01/2019	$39.22	$8.10	$16.80	$0.00	$64.12
	06/01/2020	$40.21	$8.10	$16.80	$0.00	$65.11
	12/01/2020	$41.19	$8.10	$16.80	$0.00	$66.09
	06/01/2021	$42.21	$8.10	$16.80	$0.00	$67.11
	12/01/2021	$43.22	$8.10	$16.80	$0.00	$68.12
For apprentice rates see "Apprentice- LABORER"						
TEST BORING LABORER *LABORERS - FOUNDATION AND MARINE*	12/01/2019	$39.10	$8.10	$16.80	$0.00	$64.00
	06/01/2020	$40.09	$8.10	$16.80	$0.00	$64.99
	12/01/2020	$41.07	$8.10	$16.80	$0.00	$65.97
	06/01/2021	$42.09	$8.10	$16.80	$0.00	$66.99
	12/01/2021	$43.10	$8.10	$16.80	$0.00	$68.00
For apprentice rates see "Apprentice- LABORER"						

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
TRACTORS/PORTABLE STEAM GENERATORS *OPERATING ENGINEERS LOCAL 4*	12/01/2019	$48.23	$12.50	$15.70	$0.00	$76.43
	06/01/2020	$49.31	$12.50	$15.70	$0.00	$77.51
	12/01/2020	$50.45	$12.50	$15.70	$0.00	$78.65
	06/01/2021	$51.54	$12.50	$15.70	$0.00	$79.74
	12/01/2021	$52.68	$12.50	$15.70	$0.00	$80.88
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
TRAILERS FOR EARTH MOVING EQUIPMENT *TEAMSTERS JOINT COUNCIL NO. 10 ZONE B*	12/01/2019	$35.12	$12.41	$13.72	$0.00	$61.25
	06/01/2020	$36.02	$12.41	$13.72	$0.00	$62.15
	08/01/2020	$36.02	$12.91	$13.72	$0.00	$62.65
	12/01/2020	$36.02	$12.91	$14.82	$0.00	$63.75
	06/01/2021	$36.82	$12.91	$14.82	$0.00	$64.55
	08/01/2021	$36.82	$13.41	$14.82	$0.00	$65.05
	12/01/2021	$36.82	$13.41	$16.01	$0.00	$66.24
TUNNEL WORK - COMPRESSED AIR *LABORERS (COMPRESSED AIR)*	12/01/2019	$51.38	$8.10	$17.20	$0.00	$76.68
	06/01/2020	$52.37	$8.10	$17.20	$0.00	$77.67
	12/01/2020	$53.35	$8.10	$17.20	$0.00	$78.65
	06/01/2021	$54.37	$8.10	$17.20	$0.00	$79.67
	12/01/2021	$55.38	$8.10	$17.20	$0.00	$80.68
For apprentice rates see "Apprentice- LABORER"						
TUNNEL WORK - COMPRESSED AIR (HAZ. WASTE) *LABORERS (COMPRESSED AIR)*	12/01/2019	$53.38	$8.10	$17.20	$0.00	$78.68
	06/01/2020	$54.37	$8.10	$17.20	$0.00	$79.67
	12/01/2020	$55.35	$8.10	$17.20	$0.00	$80.65
	06/01/2021	$56.37	$8.10	$17.20	$0.00	$81.67
	12/01/2021	$57.38	$8.10	$17.20	$0.00	$82.68
For apprentice rates see "Apprentice- LABORER"						
TUNNEL WORK - FREE AIR *LABORERS (FREE AIR TUNNEL)*	12/01/2019	$43.45	$8.10	$17.20	$0.00	$68.75
	06/01/2020	$44.44	$8.10	$17.20	$0.00	$69.74
	12/01/2020	$45.42	$8.10	$17.20	$0.00	$70.72
	06/01/2021	$46.44	$8.10	$17.20	$0.00	$71.74
	12/01/2021	$47.45	$8.10	$17.20	$0.00	$72.75
For apprentice rates see "Apprentice- LABORER"						
TUNNEL WORK - FREE AIR (HAZ. WASTE) *LABORERS (FREE AIR TUNNEL)*	12/01/2019	$45.45	$8.10	$17.20	$0.00	$70.75
	06/01/2020	$46.44	$8.10	$17.20	$0.00	$71.74
	12/01/2020	$47.42	$8.10	$17.20	$0.00	$72.72
	06/01/2021	$48.44	$8.10	$17.20	$0.00	$73.74
	12/01/2021	$49.45	$8.10	$17.20	$0.00	$74.75
For apprentice rates see "Apprentice- LABORER"						
VAC-HAUL *TEAMSTERS JOINT COUNCIL NO. 10 ZONE B*	12/01/2019	$34.54	$12.41	$13.72	$0.00	$60.67
	06/01/2020	$35.44	$12.41	$13.72	$0.00	$61.57
	08/01/2020	$35.44	$12.91	$13.72	$0.00	$62.07
	12/01/2020	$35.44	$12.91	$14.82	$0.00	$63.17
	06/01/2021	$36.24	$12.91	$14.82	$0.00	$63.97
	08/01/2021	$36.24	$13.41	$14.82	$0.00	$64.47
	12/01/2021	$36.24	$13.41	$16.01	$0.00	$65.66

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
WAGON DRILL OPERATOR *LABORERS - ZONE 2*	12/01/2019	$34.31	$8.10	$15.38	$0.00	$57.79
	06/01/2020	$35.20	$8.10	$15.38	$0.00	$58.68
	12/01/2020	$36.09	$8.10	$15.38	$0.00	$59.57
	06/01/2021	$37.01	$8.10	$15.38	$0.00	$60.49
	12/01/2021	$37.92	$8.10	$15.38	$0.00	$61.40
For apprentice rates see "Apprentice- LABORER"						
WASTE WATER PUMP OPERATOR *OPERATING ENGINEERS LOCAL 4*	12/01/2019	$48.73	$12.50	$15.70	$0.00	$76.93
	06/01/2020	$49.83	$12.50	$15.70	$0.00	$78.03
	12/01/2020	$50.98	$12.50	$15.70	$0.00	$79.18
	06/01/2021	$52.08	$12.50	$15.70	$0.00	$80.28
	12/01/2021	$53.23	$12.50	$15.70	$0.00	$81.43
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
WATER METER INSTALLER *PLUMBERS & GASFITTERS LOCAL 12*	09/01/2019	$57.69	$11.82	$17.01	$0.00	$86.52
	03/01/2020	$59.19	$11.82	$17.01	$0.00	$88.02
	09/01/2020	$60.69	$11.82	$17.01	$0.00	$89.52
	03/01/2021	$62.19	$11.82	$17.01	$0.00	$91.02
For apprentice rates see "Apprentice- PLUMBER/PIPEFITTER" or "PLUMBER/GASFITTER"						
Outside Electrical - East						
CABLE TECHNICIAN (Power Zone) *OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104*	09/01/2019	$28.83	$8.75	$1.86	$0.00	$39.44
	08/30/2020	$29.67	$9.25	$1.89	$0.00	$40.81
For apprentice rates see "Apprentice- LINEMAN"						
CABLEMAN (Underground Ducts & Cables) *OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104*	09/01/2019	$40.84	$8.75	$10.02	$0.00	$59.61
	08/30/2020	$42.03	$9.25	$10.27	$0.00	$61.55
For apprentice rates see "Apprentice- LINEMAN"						
DRIVER / GROUNDMAN CDL *OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104*	09/01/2019	$33.64	$8.75	$9.86	$0.00	$52.25
	08/30/2020	$34.62	$9.25	$10.07	$0.00	$53.94
For apprentice rates see "Apprentice- LINEMAN"						
DRIVER / GROUNDMAN -Inexperienced (<2000 Hrs) *OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104*	09/01/2019	$26.43	$8.75	$1.79	$0.00	$36.97
	08/30/2020	$27.20	$9.25	$1.82	$0.00	$38.27
For apprentice rates see "Apprentice- LINEMAN"						
EQUIPMENT OPERATOR (Class A CDL) *OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104*	09/01/2019	$40.84	$8.75	$14.10	$0.00	$63.69
	08/30/2020	$42.03	$9.25	$14.35	$0.00	$65.63
For apprentice rates see "Apprentice- LINEMAN"						
EQUIPMENT OPERATOR (Class B CDL) *OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104*	09/01/2019	$36.04	$8.75	$10.65	$0.00	$55.44
	08/30/2020	$37.09	$9.25	$10.87	$0.00	$57.21
For apprentice rates see "Apprentice- LINEMAN"						
GROUNDMAN *OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104*	09/01/2019	$21.62	$8.75	$1.65	$0.00	$32.02
	08/30/2020	$22.25	$9.25	$1.67	$0.00	$33.17
For apprentice rates see "Apprentice- LINEMAN"						
GROUNDMAN -Inexperienced (<2000 Hrs.) *OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104*	09/01/2019	$26.43	$8.75	$1.79	$0.00	$36.97
	08/30/2020	$27.20	$9.25	$1.82	$0.00	$38.27
For apprentice rates see "Apprentice- LINEMAN"						
JOURNEYMAN LINEMAN *OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104*	09/01/2019	$48.05	$8.75	$17.19	$0.00	$73.99
	08/30/2020	$49.45	$9.25	$17.48	$0.00	$76.18

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

Apprentice - *LINEMAN (Outside Electrical) - East Local 104*

Effective Date - 09/01/2019

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	60	$28.83	$8.75	$3.36	$0.00	$40.94
2	65	$31.23	$8.75	$3.44	$0.00	$43.42
3	70	$33.64	$8.75	$3.51	$0.00	$45.90
4	75	$36.04	$8.75	$5.08	$0.00	$49.87
5	80	$38.44	$8.75	$5.15	$0.00	$52.34
6	85	$40.84	$8.75	$5.23	$0.00	$54.82
7	90	$43.25	$8.75	$7.30	$0.00	$59.30

Effective Date - 08/30/2020

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	60	$29.67	$9.25	$3.39	$0.00	$42.31
2	65	$32.14	$9.25	$3.46	$0.00	$44.85
3	70	$34.62	$9.25	$3.54	$0.00	$47.41
4	75	$37.09	$9.25	$5.11	$0.00	$51.45
5	80	$39.56	$9.25	$5.19	$0.00	$54.00
6	85	$42.03	$9.25	$5.26	$0.00	$56.54
7	90	$44.51	$9.25	$7.34	$0.00	$61.10

Notes:

Apprentice to Journeyworker Ratio:1:2

TELEDATA CABLE SPLICER *OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104*	02/04/2019	$30.73	$4.70	$3.17	$0.00	$38.60
TELEDATA LINEMAN/EQUIPMENT OPERATOR *OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104*	02/04/2019	$28.93	$4.70	$3.14	$0.00	$36.77
TELEDATA WIREMAN/INSTALLER/TECHNICIAN *OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104*	02/04/2019	$28.93	$4.70	$3.14	$0.00	$36.77
TREE TRIMMER *OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104*	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 *OUTSIDE ELECTRICAL WORKERS - EAST LOCAL 104*	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.

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate

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.

Hart

SECTION D: BID PACKAGE

CITY OF FRAMINGHAM

IFB PW-428

Contract: Edgell Road Water Pump Station Replacement

1. CHECKLIST

This checklist is provided to assist Bidders in identifying those sections of the Bid Documents which must be completed and returned as a part of the Bid submission, as well as other items to be submitted with the Bid. This is a working document for information only.

ITEM	SECTION	ACTION REQUIED	CHECK
Addenda (if applicable)	A.5, D.2	Acknowledge all addenda issued	
Signature of Bidder	D.2	Bidder's authorized signature	
Certificate of Corporate Authority	D.3	Authorized Signatures and Notary	
Price Sheet	D.4	Unit Prices, Extensions, Totals	
Bidder Information	D.5	Provide information	
Bidder References	D. 6	Provide information	
Bid Deposit (Bid Bond or Certified Check, etc.)	D.7	Authorized signatures by Bidder and Surety Furnish in separate envelope for 5% of the value of the Bid.	
Attestation of Tax Compliance	D.8	Bidder's authorized signature	
Certificate of Non-Collusion	D.9	Bidder's authorized signature	
Affirmative Action & Equal Employment Opportunity	B.E	Bidder's authorized signature	

2. SIGNATURE OF BIDDER

To the City of Framingham:

1. The Undersigned hereby offers to perform all the obligations and to assume all the duties and liabilities of the Contractor provided for in the accompanying Section A, entitled "Instructions to Bidders"; Section B, entitled "Short Form of Agreement"; Section C, entitled "Prevailing Wage Requirements", this Section D, entitled "Bid Package"; Section E, entitled "General Conditions"; Section F, entitled "Supplementary Conditions"; and Section G, entitled "Specifications".

2. This Bid includes Addenda numbered 1 & 2.

3. The Undersigned declares that the Contract Documents have been examined carefully and that the Bidder is familiar with all of the requirements as set forth in the Contract Documents. Further, the Bidder has had an opportunity to ask questions and has secured satisfactory responses to such questions and understands that by submitting this Bid, the bidder waives any and all rights to plead any misunderstandings.

4. The Undersigned, under penalties of perjury hereby certifies the following: (1) that s/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 such documentation of successful completion of said course shall be furnished with the first certified payroll report for each employee.

5. The Undersigned agrees that, if selected as the Contractor, s/he will within ten (10) calendar days of the notification of contract award by the City, execute a contract in accordance with the terms and conditions of this bid and furnish a certificate of foreign corporation if required, and a payment bond as required under section 29 of chapter 149 and any other bonds as may be additionally required in the Contract, each of a surety company qualified to do business under the laws of the Commonwealth and satisfactory to the City and each in the sum set forth in the City's Short Form of Agreement, Article 10, the premiums for which are to be paid by the Contractor and are included in the contract price.

6. This offer shall be irrevocable for 90 calendar days after the date on which the City opens this Bid. The parties, by mutual agreement, may extend the time for acceptance of the Bid, during which time there will be no increase in Bid price or contract term.

7. The Undersigned represents and warrants that the Bidder has full and complete authority to submit this Bid and enter into a contract with the City of Framingham.

Date: 3/12/2020

Name of Bidder: Hart Engineering Corporation

Business Street Address: 800 Scenic View Drive

City, State and Zip Code: Cumberland, RI 02864

Phone: (401) 658-4600 Fax: (401) 658-4609

E-Mail: rmulligan@hartcompanies.com

(*)*Authorized Written Signature:*

Printed Name: Robert E. Mulligan

Title: Vice President

(*)Note: Bid should be signed in ink by a person having proper legal authority, and the person's title should be given, such as "owner" in the case of an individual, "partner" in the case of a general partnership, "president", "treasurer" or other authorized officer in the case of a corporation.

If Bidder is a partnership, **provide signature of one co-partner above and provide signatures of the remaining partners below (attach additional sheets if necessary):**

Written Signature _____ Printed Name _____

Written Signature _____ Printed Name _____

Written Signature _____ Printed Name _____

Written Signature _____ Printed Name _____

3. *CERTIFICATE OF CORPORATE AUTHORITY*

AT A DULY AUTHORIZED MEETING OF THE BOARD OF DIRECTORS OF THE Hart Engineering Corporation (name of corporation)
held on 3/11/2020 (date) Directors were present or waived notice, it was voted that Robert E. Mulligan
Vice President (name and title) of this company be and hereby is authorized to execute contracts and bonds
in the name and behalf of said company, and affix its Corporate Seal thereto, and such execution
of any contract or bond of obligation in this company's name on its behalf of such Vice President (OFFICER)
under seal of the company shall be valid and binding upon this company.

A TRUE COPY

ATTEST: Frank A Carnevale
CFO/Vice President/Secretary/Treasurer

Place of Business:
800 Scenic View Drive
Cumberland, RI 02864

I hereby certify that I am the Secretary/Treasurer (Title) of the Hart Engineering Corporation (Name of Corporation)

that Robert E. Mulligan (Name of Officer) is the duly elected Vice President (Title) of said
company, and the above vote has not been amended or rescinded and remains in full force and
effect as of the date of this contract.

Signature: Frank A Carnevale
Name/Title: CFO/Vice President/Secretary/Treasurer
Date: 3/11/2020

(Corporate Seal)

COMMONWEALTH OF MASSACHUSETTS, SS. 3/11, 20 20

Then personally appeared the above named Frank A Carnevale and acknowledged the
foregoing instrument to be his/her free act and deed before me.

NOTARY PUBLIC
My commission expires: 6.17.21

PW-428 EDGELL ROAD WATER PUMP STATION REPLACEMENT

ADDENDUM ONE PRICE SHEET

THIS ADDENDUM ONE PRICE SHEET MUST BE SUBMITTED WITH ALL PW-428 BIDS

Instructions:

(1) **Insert Total Price for Each Item**

(2) **Add all products in the Total Price Column and insert the sum for the Total Estimated Price for Bid Evaluation Purposes**

In the event of a discrepancy between a Unit Bid Price and Total Price, the Unit Price shall control.

Item #	Quantity	Unit	Description	(1) Total Price
1	1	Lump Sum	Edgell Road Water Pump Station Replacement	$ 3,126,000
2	1	Allowance	Electric Service Allowance	$ 50,000.00

(2) Total Estimated Contract Price for Bid Evaluation Purposes	$ 3,176,000

THREE MILLION, ONE HUNDRED SEVENTY SIX THOUSAND

Total Estimated Contract Price for Bid Evaluation Purposes ***in WORDS***

Name of Bidder HART ENGINEERING CORPORATION

5. BIDDER INFORMATION

Bidder: Hart Engineering Corporation

Business Trade or Field: General Contractor in Water and Wastewater Treatment

Previous experience in this trade or field is 35 years.

Equipment owned by the Bidder and planned to be used on jobs in Framingham:

Welding Machines, Lifts, Forklift, Compressors

Bidder shall list all projects that his/her company defaulted on and reasons for defaults:

None

6. BIDDER REFERENCE FORM

Bidder Name: Hart Engineering Corporation

Please provide a list of references on the firm's performance of similar work as required by this IFB within the required time period designated in Section A, under the Item entitled "Bidder Prerequisites", including all current contracts. Use additional sheets as necessary. Include the following information for each reference:

Reference One

Customer Name: See attached DCAMM Update Statement

Address: _____

Contact Name and Title: _____

Phone and Fax/E-Mail of Contact: _____

Contract date(s): _____

Contract cost: _____

Description of Work: _____

_____

_____

Reference Two

Customer Name: _____

Address: _____

Contact Name and Title: _____

Phone and Fax/E-Mail of Contact: _____

Contract date(s): _____

Contract cost: _____

Description of Work: _____

_____

_____

Reference Three

Customer Name: _____

Address: _____

Contact Name and Title: _____

Phone and Fax/E-Mail of Contact: _____

Contract date(s): _____

Contract cost: _____

Description of Work: _____

_____

_____

Reference Four

Customer Name: _____

Address: _____

Contact Name and Title: _____

Phone and Fax/E-Mail of Contact: _____

Contract date(s): _____

Contract cost: _____

Description of Work: _____

_____

_____

Reference Five

Customer Name: _____

Address: _____

Contact Name and Title: _____

Phone and Fax/E-Mail of Contact: _____

Contract date(s): _____

Contract cost: _____

Description of Work: _____

_____

_____

Reference Six

Customer Name: _____

Address: _____

Contact Name and Title: _____

Phone and Fax/E-Mail of Contact: _____

Contract date(s): _____

Contract cost: _____

Description of Work: _____

_____

_____

8. ATTESTATION OF TAX COMPLIANCE

I certify under the penalties of perjury that, to the best of my knowledge and belief, I am in compliance with all laws of the Commonwealth relating to taxes, reporting of employees and contractors, and withholding and remitting child support. Pursuant to M.G.L. ch. 62C, §49A, I certify under the penalties of perjury that I, to my best knowledge and belief, have filed all state tax returns and paid all State Taxes Required under law.

HART ENGINEERING CORPORATION INCORPORATED 1984 RHODE ISLAND

Hart Engineering Corporation

*Signature of Individual or Corporate Name **(Mandatory)**

05-0408406

Social Security Number or Federal Identification Number **(Mandatory)

By: Robert E. Mulligan, Vice President Date: 3/12/2020

Corporate Officer
(Mandatory, if Applicable)

*Approval of a contract or other agreement will not be granted unless this certification clause is signed by the applicant.

Your social security number will be furnished to the Massachusetts Department of Revenue to determine whether you have met tax filing and tax payment obligations. Providers who fail to correct their non-filing or delinquency status **will not have a contract or other agreement issued, renewed, or extended. This request is made under the authority of Mass. G.L. Ch. 62c, Sec.49A.

9. CERTIFICATE OF NON-COLLUSION

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 in this certification, the word "person" shall mean any natural person, joint venture, partnership, corporation or other business or legal entity.

(Signature of Person Signing Bid)
Robert E. Mulligan, Vice President

HART ENGINEERING CORPORATION INCORPORATED 1984 RHODE ISLAND

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EXHIBIT E - Affirmative Action & Equal Employment Opportunity Requirements

Pursuant to Article X, Section 1 of the Framingham Home Rule Charter adopted on April 4, 2017 "All general laws, special laws, town by-laws, town meeting votes, and rules and regulations of or pertaining to Framingham that are in force when this charter takes effect, and not specifically or by implication repealed by this charter, shall continue in full force and effect until amended or repealed, or rescinded by due course of law, or until they expire by their own limitation...."

Section 1 - AFFIRMATIVE ACTION REQUIREMENTS
Bidders are advised of the requirements of the following City By-law, which was adopted at the Special Framingham Town Meeting of December 8, 1971 and approved by the Attorney General on March 14, 1972.

Section 2 - No City agency shall enter into any contract for the purchase of goods or services for the construction, maintenance, renovation or repair of any building, structure, street, way, utility or other public works with any contractor which does not take affirmative action to provide equal employment for all qualified persons without regard to race, color, religion, sex or national origin.

Section 3 - Each bidder and contractor shall include with all bids and all compliance and progress reports submitted to any agency or a report, which shall include:

A certificate stating that he is currently in compliance with the provisions of the Massachusetts General Laws, Chapter 151 governing non discrimination in employment and setting forth the affirmative action he is currently undertaking and will undertake during the contract period to provide equal employment opportunity for all qualified persons without regard to race, color, religion, sex or national origin. A copy of any such report shall be filed in the office of the Town Clerk and shall upon filing become a public record.

Section 4 - Every Town Agency shall include in every contract hereinafter entered into the purchase of goods or services or for the construction, maintenance, renovation services or repair of any buildings, structure, street, way utility or other public works the following provisions:
During the performance of this contract, the contractor agrees as follows:

a. The contractor will take affirmative action to ensure that employees are solicited and employed and that the employees are treated during employment without regard to race, color, religion, sex or national origin.

b. The contractor will in all solicitation or advertisements for employees placed by on behalf of the contractor, state that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex or national origin.

c. The contractor and subcontractors will include the provisions of subsections (a) and (b) above in every subcontract or purchase order.

Section 5 - As used in this section, affirmative action means positive steps to ensure all qualified persons equal employment without regard to race, color, religion, sex or national origin at all stages of the employment process, recruitment, selection, placement, promotion, training, layoff and termination. It may include, but not limited to the following:

- Inclusion in all solicitation and advertisements for employees of a statement that the contractor is an "Equal Opportunity Employer."
- Placement of solicitation and advertisements for employees in media that reaches minority groups.
- Notification in writing of all recruitment sources that the contractor solicits the referral of applicants without regard to race, color, religion, sex or national origin.
- Direct solicitation of the support of responsible and appropriate community, state and federal agencies to assist in recruitment efforts.
- Participation is or establishment of apprenticeship or training programs where outside programs are inadequate or unavailable to minority groups.
- Modification or collective bargaining agreements to eliminate restrictive barriers established by dual lines of seniority, dual rates of pay or dual lines of promotion or progression which are based on race, color, religion, sex or national origin.

Section 6 - The Human Relations Commission shall receive and investigate or cause to be investigated complaints by employees or prospective employees of a Town contractor, subcontractor, or supplier. Findings and determinations on such investigations, together with the records and recommendations, shall be reported by the Human Relations Commission to the Board of Selectmen and the contracting agency concerned. The Human Relations Commission shall cooperate with the Board of Selectmen and with each contracting agency by providing assistance in reviewing affirmative action plans, and to contractors seeking qualified minority group employees, and shall itself seek such employees.

Section 7 - The provision of this section shall not apply to any contract for less than $5,000 or to bidders and contractors employing fewer than six persons provided that where the contract is for less than $5,000 but not less than $2,000, any Town agency may apply the provision of this section to any contract, bidder, or contractor.

EQUAL EMPLOYMENT OPPORTUNITY

No person in the United States shall, on the grounds of race, color, national origin, or sex, be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any program or activity receiving Federal financial assistance. Reference Title VI of the Civil Rights Act of 1964 (42 USC 2000d) and Section 112 of Public Law 92-65.

Form EDA-503. The Recipient and all Contractors, subcontractors, suppliers, lessees and other parties directly participating in the Recipient's project agree that during and in connection with the associated agreement relating to the Federally assisted program.
(1) They will comply, to the extent applicable, as Contractors, subcontractors, lessees, suppliers, or in any other capacity, with the applicable provisions of the Regulations of the United States Department of Commerce (Part 8 of Subtitle A of Title 15 of the Code of Federal Regulations) issued pursuant to Title VI of the Civil Rights Act of 1964 (P.L. 88-352), and will not thereby

discriminate against any person on the grounds of race, color, or national origin in their employment practices, in any of their own contractual arrangements, in all services or accommodations which they offer to the public, and in any of their other business operations, (2) they will provide information required by or pursuant to said Regulations to ascertain compliance with the Regulations and these assurances, and (3) their non-compliance with the nondiscrimination requirements of said Regulations and these assurances shall constitute a breach of their contractual arrangements with the Recipient whereby said agreements may be canceled, terminated or suspended in whole or in part or may be subject to enforcement otherwise by appropriate legal proceedings.

Executive Order 11246, 30 Fed. Reg. 12319 (1965) (Equal Opportunity Clause)
During the performance of this contract, the Contractor agrees as follows:

a. The Contractor will no discriminate against any employee or applicant for employment because of race, color, religion, sex, or national origin. The Contractor will take affirmative action to ensure the applicants, are employed, and that employees are treated during employment, without regard to their race, color, religion, sex, or national origin. Such action shall include, but not be limited to the following: employment, upgrading, demotion, or transfer; recruitment or recruitment advertising, layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship.

b. The Contractor agrees to post in conspicuous places available to employees and applicants for employment, notices to be provided by the contracting officer setting forth the provisions of this non-discrimination clause.

c. The Contractor will, in all solicitations or advertisements for employees placed by or on behalf of the contractor, state that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex, or national origin.

d. The Contractor will send to each labor union or representative of workers with which he has a collective bargaining agreement or other contract or understanding, a notice to be provided by the agency contracting officer, advising the labor union or workers' representative of the Contractor's commitment under Section 202 of Executive Order No. 11246 of September 24, 1965, and shall post copies of the notice in conspicuous places available to employees and applicants for employment.

e. The Contractor will comply with all provisions of Executive Order No. 11246 of September 24, 1965, and of rules, regulations, and relevant orders of the Secretary of Labor.

f. The Contractor will furnish all information and reports required by Executive Order No. 11246 of September 24, 1965, and by rules, regulations, and orders of the Secretary of Labor, or pursuant thereto, and will permit access to his books, record, and accounts by the contracting agency and the Secretary of Labor for purposes of investigation to ascertain compliance with such rules, regulations, and orders. Each Contractor and subcontractor of federally financed construction work is required to file an Equal Employment Opportunity Employer Information Report (EEO-1 on Standard Form 100) annually on March 31. Forms and instructions are available at the EDA Regional Office.

g. In the event of the Contractor' noncompliance with the non-discrimination clauses of this contract or with any such rules, regulations, or orders, this contract may be canceled, terminated or suspended in whole or in part and the Contractor may be declared ineligible for further Government contracts in accordance with procedures authorized in Executive Order No. 11246 of September 24, 1965, and such other sanctions may be imposed (and remedies involved) as provided in Executive Order No. 11246 of September 24, 1965, or by rule, regulation, or order of the Secretary of Labor, or as otherwise provided by law.

h. The Contractor will include the provisions of paragraphs a through h in every subcontract or purchase order unless exempted by rules, regulations, or orders of the Secretary of Labor issued pursuant to Section 204 of Executive Order No. 11246 of September 24, 1965, so that such provisions will be binding upon each subcontractor or vendor. The Contractor will take such action with respect to any subcontractor or purchase order as the contracting agency may direct as a means of enforcing such provisions including sanctions for noncompliance; Provided, however, that in the event the contractor becomes involved in, or is threatened with litigation with a subcontractor or vendor as a result of such direction by the contracting agency, the Contractor may request the United States to enter into such litigation to protect the interest of the United States.

1. Exemptions to Above Equal Opportunity Clause (4) CFR Chap.60):

(1) Contracts and subcontracts not exceeding $10,000 (other than government bills of lading) are exempt. The amount of the contract, rather than the amount of the Federal financial assistance, shall govern in determining the applicability of this exemption.

(2) Except in the case of subcontractors for the performance of construction work at the site of construction, the clause shall not be required to be inserted in subcontracts below the second tier.

(3) Contracts and subcontracts not exceeding $100,000 for standard commercial supplies or raw materials are exempt.

OTHER PROHIBITED INTEREST

No official of the Owner who is authorized in such capacity and on behalf of the Owner to negotiate, make, accept, or approve, or to take part in negotiating, making, accepting, or approving any architectural, engineering, inspection, construction or material supply contract or any subcontract in connection with the construction of the project, shall become directly or indirectly interested personally in this contract or in any part hereof. No officer, employee, architect, attorney, engineer or inspector of or for the Owner who is authorized in such capacity and on behalf of the Owner to exercise any legislative, executive, supervisory or other similar functions in connection with the construction of the project, shall become directly or indirectly interest personally in this contract or in any part thereof, any material supply contract, subcontract, insurance contract, or any other contract pertaining to the project.

City of Framingham, Massachusetts

Date 3/12/2020

To: City of Framingham, Framingham, MA

I have read the Affirmative Action Requirements and Equal Employment Opportunity as adopted by the Town of Framingham on December 8, 1971 and approved by the Massachusetts Attorney General on March 14, 1972 and agree to affirmatively implement all practices necessary to comply with said requirements.

A copy of a portion of the City By-law is attached as part of the bid specifications.

Signed Robert E. Mulligan — Vice President
Name — Title

HART ENGINEERING CORPORATION INCORPORATED 1984 RHODE ISLAND

Company Hart Engineering Corporation

Contract No.: **PW # 428** For: [Edgell Rd. Water Pump Station Replacement]

The Commonwealth of Massachusetts
Executive Office for Administration and Finance
Division of Capital Asset Management and Maintenance
One Ashburton Place
Boston, Massachusetts 02108
Tel: (617) 727-4050
Fax: (617) 727-5363

CHARLES D. BAKER
GOVERNOR

KARYN E. POLITO
LIEUTENANT GOVERNOR

MICHAEL J. HEFFERNAN
SECRETARY, ADMINISTRATION & FINANCE

CAROL W. GLADSTONE
COMMISSIONER

Prime/General
Certificate of Contractor Eligibility

CONTRACTOR IDENTIFICATION NUMBER: 0285

This Certificate Shall Be Used for Submitting Prime/General Bids Only

1. **CERTIFICATION PERIOD:** **This Certificate is valid from 5/22/2019 to 5/21/2020**
2. **CONTRACTOR'S NAME:** **Hart Engineering Corporation**
3. **CONTRACTOR'S ADDRESS:** **800 Scenic View Drive, Cumberland, RI 02864**
4. **WORK CATEGORIES:** **This Contractor is certified to file bids under Massachusetts General Laws Chapter 149, Chapter 149A and Chapter 25A in the following checked Categories of Work:**

☐ Alarm Systems	☐ Elevators	☐ Historical Masonry	☐ Painting
☐ Asbestos Removal	☐ Energy Management Systems	☐ Historical Painting	☐ Plumbing
☐ Deleading	☐ Exterior Siding	☐ Historical Roofing	☑ **Pumping Stations**
☐ Demolition	☐ Fire Protection Sprinkler Systems	☐ HVAC	☐ Roofing
☐ Doors & Windows	☐ Floor Covering	☐ Masonry	☑ **Sewage & Water Treatment Plants**
☐ Electrical	☑ **General Building Construction**	☑ **Mechanical Systems**	☐ Telecommunication Systems
☐ Electronic Security Systems	☐ Historical Building Restoration	☐ Modular Construction/Prefab	☐ Waterproofing

5. **EVALUATIONS:**
   - **Number of Projects Evaluated:** **22**
   - **Average Project Evaluation Rating:** **96**
   - **Number of Projects Below Passing Score:** **0**
6. **PROJECT LIMITS:**
   - **Single Project Limit (SPL):** **$53,134,438.00**
   - **Aggregate Work Limit (AWL):** **$94,502,000.00**
   - **General Building Construction Limit:** **$53,134,438.00**
7. **SUPPLIER DIVERSITY OFFICE CERTIFICATION:** **N/A**

Brian McPherson, Director of Access and Opportunity,
for Carol W. Gladstone, Commissioner

5/22/2019
Approval Date

NOTE TO CONTRACTORS: ***Complete Applications for Renewal of Contractor Eligibility are due no later than three months PRIOR to the Expiration Date of the Certification Period shown above. Failure to submit Completed Applications timely may result in a gap in Certification or a lapse in Certification altogether for your company.***

Reviewer's Initials MR

SPECIAL NOTICE TO AWARDING AUTHORITY
BIDDERS' UPDATE STATEMENTS ARE NOT PUBLIC RECORDS AND ARE NOT OPEN TO PUBLIC INSPECTION (M.G.L. C.149, §44D)

EFFECTIVE MARCH 30, 2010

Commonwealth of Massachusetts
Division of Capital Asset Management
PRIME/GENERAL CONTRACTOR UPDATE STATEMENT

TO ALL BIDDERS AND AWARDING AUTHORITIES

A COMPLETED AND SIGNED PRIME/GENERAL CONTRACTOR UPDATE STATEMENT MUST BE SUBMITTED WITH EVERY PRIME/GENERAL BID FOR A CONTRACT PURSUANT TO M.G.L. c.149, §44A AND M.G.L. c. 149A. ANY PRIME/GENERAL BID SUBMITTED WITHOUT AN APPROPRIATE UPDATE STATEMENT IS INVALID AND MUST BE REJECTED.

Caution: This form is to be used for submitting Prime/General Contract bids. It is not to be used for submitting Filed Sub-Bids or Trade Sub-Bids.

AWARDING AUTHORITIES

If the Awarding Authority determines that the bidder does not demonstrably possess the skill, ability, and integrity necessary to perform the work on the project, it must reject the bid.

BIDDER'S AFFIDAVIT

I swear under the pains and penalties of perjury that I am duly authorized by the bidder named below to sign and submit this Prime/General Contractor Update Statement on behalf of the bidder named below, that I have read this Prime/General Contractor Update Statement, and that all of the information provided by the bidder in this Prime/General Contractor Update Statement is true, accurate, and complete as of the bid date.

3/12/2020 Bid Date	Hart Engineering Corporation Print Name of Prime/General Contractor
Edgell Road Water Pump Station Replacement - PW-428 Project Number (or name if no number)	800 Scenic View Drive, Cumberland, RI 02864 Business Address
City of Framingham, MA Awarding Authority	401-658-4600 Telephone Number

SIGNATURE⇨ Robert E. Mulligan - Vice President

Bidder's Authorized Representative

HART ENGINEERING CORPORATION INCORPORATED 1984 RHODE ISLAND

INSTRUCTIONS

INSTRUCTIONS TO BIDDERS

- This form must be completed and submitted by all Prime/General contractors bidding on projects pursuant to M.G.L. c. 149, §44A and M.G.L. c. 149A.
- You must give complete and accurate answers to all questions and provide all of the information requested. MAKING A MATERIALLY FALSE STATEMENT IN THIS UPDATE STATEMENT IS GROUNDS FOR REJECTING YOUR BID AND FOR DEBARRING YOU FROM ALL PUBLIC CONTRACTING.
- **This Update Statement must include all requested information that was not previously reported on the Application used for your firm's most recently issued (not extended or amended) Prime/General Contractor Certificate of Eligibility. The Update Statement must cover the entire period since the date of your Application, NOT since the date of your Certification.**
- You must use this official form of Update Statement. Copies of this form may be obtained from the awarding authority and from the Asset Management Web Site: www.mass.gov/dcam .
- If additional space is needed, please copy the appropriate page of this Update Statement and attach it as an additional sheet.
- See the section entitled "Bidding Limits" in the *Instructions to Awarding Authorities* for important information concerning your bidding limits.

INSTRUCTIONS TO AWARDING AUTHORITIES

Determination of Bidder Qualifications

- It is the awarding authority's responsibility to determine who is the lowest eligible and responsible bidder. You must consider all of the information in the low bidder's Update Statement in making this determination. Remember: this information was not available to the Division of Capital Asset Management at the time of certification.
- The bidder's performance on the projects listed in Parts 1 and 2 must be part of your review. Contact the project references.
- AWARDING AUTHORITIES ARE STRONGLY ENCOURAGED TO REVIEW THE LOW BIDDER'S ENTIRE CERTIFICATION FILE AT THE DIVISION OF CAPITAL ASSET MANAGEMENT. Telephone (617) 727-9320 for an appointment.

Bidding Limits

Single Project Limit: The total amount of the bid, including all alternates, may not exceed the bidder's Single Project Limit.

Aggregate Work Limit: The annual value of the work to be performed on the contract for which the bid is submitted, when added to the annual cost to complete the bidder's other currently held contracts, may not exceed the bidder's Aggregate Work Limit. Use the following procedure to determine whether the low bidder is within its Aggregate Work Limit:

Step 1 Review Update Statement Question #2 to make sure that all requested information is provided and that the bidder has accurately calculated and totaled the annualized value of all incomplete work on its currently held contracts (column 9).

Step 2 Determine the annual dollar value of the work to be performed on your project. This is done as follows:

(i) If the project is to be completed in less than 12 months, the annual dollar value of the work is equal to the full amount of the bid.

(ii) If the project will take more than 12 months to complete, calculate the number of years given to complete the project by dividing the total number of months in the project schedule by 12 (calculate to 3 decimal places), then divide the amount of the bid by the calculated number of years to find the annual dollar value of the work.

Step 3 Add the annualized value of all of the bidder's incomplete contract work (the total of column 9 on page 5) to the annual dollar value of the work to be performed on your project. **The total may not exceed the bidder's Aggregate Work Limit**.

Correction of Errors and Omissions in Update Statements

Matters of Form: An awarding authority shall not reject a contractor's bid because there are mistakes or omissions of form in the Update Statement submitted with the bid, provided the contractor promptly corrects those mistakes or omissions upon request of the awarding authority. [810 CMR 8.05(1)].

Correction of Other Defects: An awarding authority may, in its discretion, give a contractor notice of defects, other than mistakes or omissions of form, in the contractor's Update Statement, and an opportunity to correct such defects, provided the correction of such defects is not prejudicial to fair competition. An awarding authority may reject a corrected Update Statement if it contains unfavorable information about the contractor that was omitted from the Update Statement filed with the contractor's bid. [810 CMR 8.05(2)].

PART 1 - COMPLETED PROJECTS

LIST ALL PUBLIC AND PRIVATE *BUILDING* PROJECTS YOUR FIRM HAS COMPLETED SINCE THE DATE OF APPLICATION FOR YOUR MOST RECENTLY ISSUED (NOT EXTENDED OR AMENDED) DCAM CERTIFICATE OF ELIGIBILITY. YOU MUST REPORT ALL REQUESTED INFORMATION NOT PREVIOUSLY REPORTED ON THAT DCAM APPLICATION*.

PROJECT TITLE & LOCATION	WORK CATEGORY	CONTRACT PRICE	START DATE	DATE COMPLETED
PJ Holton Purification Plant- Influent System Upgrade 4900	General Building Construction	$6,837,737	9/10/2013	12/31/2018
Somerset WTP & WPCF Sodium Hypochlorite	Sewage & Water Treatment	$1,212,571	10/31/2016	6/20/2017
Fields Point Final Clarifier & Misc Improvments	Sewage & Water Treatment	$3,818,738	1/26/2017	9/1/2018
Fields Point WWTF Blower Improvements Phase II	Sewage & Water Treatment	$7,828,500	1/26/2017	9/1/2018
2016 Wastewater Treatment & Collection Systems Improvements Project	Sewage & Water Treatment	$761,930	8/25/2016	2/11/2019
BPWWTF - Digester Pipe and Miscellaneous Improvements	Sewage & Water Treatment	$1,168,552	5/3/2017	12/31/2018

Attach additional sheets if necessary

* If your firm has been terminated from a project prior to completion of the work or has failed or refused to complete its work under any contract, full details and an explanation must be provided. See Part 3 of this Update Statement.

PART 1 - COMPLETED PROJECTS

LIST ALL PUBLIC AND PRIVATE *BUILDING* PROJECTS YOUR FIRM HAS COMPLETED SINCE THE DATE OF APPLICATION FOR YOUR MOST RECENTLY ISSUED (NOT EXTENDED OR AMENDED) DCAM CERTIFICATE OF ELIGIBILITY. YOU MUST REPORT ALL REQUESTED INFORMATION NOT PREVIOUSLY REPORTED ON THAT DCAM APPLICATION*.

PROJECT TITLE & LOCATION	WORK CATEGORY	CONTRACT PRICE	START DATE	DATE COMPLETED
Taunton - Sedimentation Basis and Generator Building Upgrades	Sewage & Water Treatment	$1,140,300	4/11/2017	12/31/2018
East Greenwich WWTF Upgrades	Sewage & Water Treatment	$4,976,422	6/14/2017	12/31/2018

Attach additional sheets if necessary

* If your firm has been terminated from a project prior to completion of the work or has failed or refused to complete its work under any contract, full details and an explanation must be provided. See Part 3 of this Update Statement.

PROVIDE THE FOLLOWING REFERENCE INFORMATION FOR EACH COMPLETED PROJECT LISTED ON THE PREVIOUS PAGE.

PROJECT TITLE	COMPANY NAME	CONTACT PERSON	TELEPHONE
Philip J. Holton Purification Plant - Influent System Upgrade	OWNER: Providence Water Supply Board	Contact Person Leo Fontaine	Telephone 401-521-6300
	DESIGNER: CDR Maguire	Contact Person Barry Pociask	Telephone 860-563-3158
	GC: Hart Engineering Corp	Contact Person Robert Mulligan	Telephone 401-658-4600
Somerset WTP & WPCF Sodium Hypochlorite	OWNER: Town of Somerset	Contact Person Robert Lima	Telephone 508-679-2731
	DESIGNER: Wright-Pierce	Contact Person Chris Grillo	Telephone 401-383-2776
	GC: Hart Engineering Corp	Contact Person James Ramos	Telephone 401-658-4600
FieldsPoint Final Clarifier & Misc Improvements	OWNER: Narraganset Bay Commission	Contact Person Richard Bernier	Telephone 401-461-8848
	DESIGNER: " "	Contact Person " "	Telephone " "
	GC: Hart Engineering Corp	Contact Person Robert Mulligan	Telephone 401-658-4600
Fields Point WWTF Blower Improvements Phase II	OWNER: Narraganset Bay Commission	Contact Person Richard Bernier	Telephone 401-461-8848
	DESIGNER: " "	Contact Person " "	Telephone "
	GC: Hart Engineering Corp	Contact Person Robert Mulligan	Telephone 401-658-4600
2016 Wastewater Treatment & Collection Systems Improvements Project	OWNER: Town of New Shoreham	Contact Person Chris Blane	Telephone 401-662-9051
	DESIGNER: James Geremia & Associates	Contact Person James Geremia	Telephone 401-454-7000
	GC: Hart Engineering Corp	Contact Person James Ramos	Telephone 401-658-4600
BPWWTF - Digester Pipe and Miscellaneous Improvements	OWNER: Narraganset Bay Commission	Contact Person Richard Bernier	Telephone 401-461-8848
	DESIGNER: " "	Contact Person " "	Telephone " "
	GC: Hart Engineering Corp	Contact Person James Ramos	Telephone 401-658-4600

Is your company or any individual who owns, manages or controls your company affiliated with any owner, designer or general contractor named above, either through a business or family relationship? [X] YES [ ] NO

Are any of the contact persons named above affiliated with your company or any individual who owns, manages or control your company, either through a business or family relationship? [X] YES [ ] NO

If you have answered YES to either question, explain. Hart Engineering as GC

PROVIDE THE FOLLOWING REFERENCE INFORMATION FOR EACH COMPLETED PROJECT LISTED ON THE PREVIOUS PAGE.

PROJECT TITLE	COMPANY NAME	CONTACT PERSON	TELEPHONE
Taunton - Sedimentation Basis and Generator Building Upgrades	OWNER: City of Taunton	Contact Person Bill Schwartz	Telephone 508-947-0690
	DESIGNER: Tighe & Bond Inc	Contact Person Ben Levesque	Telephone 508-471-9648
	GC: Hart Engineering Corp	Contact Person James Ramos	Telephone 401-658-4600
East Greenwich WWTF Upgrades	OWNER: Town of East Greenwich	Contact Person Joseph Duarte	Telephone 401-886-8621
	DESIGNER: Tighe & Bond Inc	Contact Person Ian Catlow	Telephone 508-471-9648
	GC: Hart Engineering Corp	Contact Person James Ramos	Telephone 401-658-4600
	OWNER:	Contact Person	Telephone
	DESIGNER:	Contact Person	Telephone
	GC:	Contact Person	Telephone
	OWNER:	Contact Person	Telephone
	DESIGNER:	Contact Person	Telephone
	GC:	Contact Person	Telephone
	OWNER:	Contact Person	Telephone
	DESIGNER:	Contact Person	Telephone
	GC:	Contact Person	Telephone
	OWNER:	Contact Person	Telephone
	DESIGNER:	Contact Person	Telephone
	GC:	Contact Person	Telephone

Is your company or any individual who owns, manages or controls your company affiliated with any owner, designer or general contractor named above, either through a business or family relationship? [X] YES [ ] NO

Are any of the contact persons named above affiliated with your company or any individual who owns, manages or control your company, either through a business or family relationship? [X] YES [ ] NO

If you have answered YES to either question, explain. Hart Engineering as GC

PART 2 - CURRENTLY HELD CONTRACTS

LIST ALL PUBLIC AND PRIVATE BUILDING AND NON-BUILDING *CONSTRUCTION* PROJECTS YOUR FIRM HAS UNDER CONTRACT ON THIS DATE REGARDLESS OF WHEN OR WHETHER THE WORK COMMENCED.

1	2	3	4	5	6	7	8	9
PROJECT TITLE & LOCATION	WORK CATEGORY	START AND END DATES	ON SCHEDULE (yes / no)	CONTRACT PRICE	% NOT COMPLETE	$ VALUE OF WORK NOT COMPLETE (col. 5 X col. 6)	NO. OF YEARS REMAINING (see note below)	ANNUALIZED VALUE OF INCOMPLETE WORK (col. 7 ÷ col. 8) (divided by)
PJ. Holton Purification Plant - Lime System Replacements	Sewage & Water Treatment Plant	6/1/2019	Yes	$1,245,262	95%	$1,182,998.90	1	$1,182,998.90
BCWA - Metacom Avenue Pump Station Upgrades	General Building Construction	9/25/2017	Yes	$1,880,024	8%	$150,401.92	1	$150,401.92
Milford - Sludge Handling Facility	General Building Construction	5/8/2017	Yes	$4,735,121	60%	$1,894,048.40	1	$ 1,894,048.40
Southbridge WWTF - Phosphorus Removal Sludge	Sewage & Water Treatment Plants	7/10/2017	Yes	$2,702,705	7%	$189,189.35	1	$189,189.35
Southbridge WWTF - Bio-Tower Upgrade	Sewage & Water Treatment Plants	7/10/2017	Yes	$1,192,473	14%	$166,946.22	1	$166,946.22

ANNUALIZED VALUE OF ALL INCOMPLETE CONTRACT WORK (Total of Column 9) $_____

Column 8
- If less than one year is left in the project schedule, write 1.
- If more than 12 months are left in the project schedule, divide the number of months left in the project schedule by 12 (calculate to three decimal places).

PART 2 - CURRENTLY HELD CONTRACTS

LIST ALL PUBLIC AND PRIVATE BUILDING AND NON-BUILDING *CONSTRUCTION* PROJECTS YOUR FIRM HAS UNDER CONTRACT ON THIS DATE REGARDLESS OF WHEN OR WHETHER THE WORK COMMENCED.

1	2	3	4	5	6	7	8	9
PROJECT TITLE & LOCATION	WORK CATEGORY	START AND END DATES	ON SCHEDULE (yes / no)	CONTRACT PRICE	% NOT COMPLETE	$ VALUE OF WORK NOT COMPLETE (col. 5 X col. 6)	NO. OF YEARS REMAINING (see note below)	ANNUALIZED VALUE OF INCOMPLETE WORK (col. 7 ÷ col. 8) (divided by)
Fairhaven - Upgrade to WPCF Preliminary Treatment Facility	Sewage & Water Treatment Plants	8/14/2017	Yes	$5,455,094	23%	$1,254,671.62	1	$1,254,671.62
Warren	Sewage & Water Treatment Plants	5/2/2018	Yes	$13,787,162	60%	$8,272,297.20	1	$8,272,297.20
NBC Grit	Sewage & Water Treatment Plants	7/16/2019	Yes	$677,000	29%	$196,330.00	1	$196,300.00
Somerset New Equipment @ WTP & WPCF	Sewage & Water Treatment Plants	2/18/2019	Yes	$503,300	100%	$503,300.00	1	$503,300.00
Taunton MLPS	Pumping Stations	2/18/2019	Yes	$7,776,000	100%	$7,776,000.00	1	$7,776,000

ANNUALIZED VALUE OF ALL INCOMPLETE CONTRACT WORK (Total of Column 9) $ 21,586,153.61

Column 8
- If less than one year is left in the project schedule, write 1.
- If more than 12 months are left in the project schedule, divide the number of months left in the project schedule by 12 (calculate to three decimal places).

PROVIDE THE FOLLOWING REFERENCE INFORMATION FOR EACH INCOMPLETE PROJECT LISTED ON THE PREVIOUS PAGE.

PROJECT TITLE	COMPANY NAME	CONTACT PERSON	TELEPHONE
Philip J. Holton Purification Plant - Lime System Replacements	OWNER: Providence Water Supply Board	Contact Person Leo Fontaine	Telephone 401-521-6300
	DESIGNER: " "	Contact Person " "	Telephone " "
	GC: Hart Engineering Corp	Contact Person Robert Mulligan	Telephone 401-658-4600
BCWA - Metacom Avenue Pump Station Upgrades	OWNER: Bristol County Water Authority	Contact Person Pamela Marchand	Telephone 401-245-2022
	DESIGNER: Pare Corp	Contact Person Marc Weller	Telephone 401-334-4108
	GC: Hart Engineering Corp	Contact Person James Ramos	Telephone 401-658-4600
Milford - Sludge Handling Facility	OWNER: Town of Milford	Contact Person Thomas Morelli	Telephone 508-473-2054
	DESIGNER: Tata & Howard, Inc	Contact Person Meaghan Heslin	Telephone 508-303-9400
	GC: Hart Engineering Corp	Contact Person Robert Mulligan	Telephone 401-658-4600
Southbridge WWTF - Phosphorus Removal and Sludge Dewatering Upgrades	OWNER: Town of Southbridge	Contact Person Heather Blakeley	Telephone 508-764-5403
	DESIGNER: Stantec	Contact Person Justin Motta	Telephone 978-692-1913
	GC: Hart Engineering Corp	Contact Person Robert Mulligan	Telephone 401-658-4600
Southbridge WWTF - Bio-Tower Upgrade	OWNER: Town of Southbridge	Contact Person Heather Blakeley	Telephone 508-764-5403
	DESIGNER: Stantec	Contact Person Justin Motta	Telephone 978-692-1913
	GC: Hart Engineering Corp	Contact Person Robert Mulligan	Telephone 401-658-4600
Fairhaven - Upgrade to WPCF Preliminary Treatment Facility and Clarifiers, and Railroad Ave. and Pilgrim Ave Pumping Stations	OWNER: Town of Fairhaven	Contact Person Rene Robillard	Telephone 508-979-4030
	DESIGNER: Stantec	Contact Person Justin Motta	Telephone 978-692-1913
	GC: Hart Engineering Corp	Contact Person James Ramos	Telephone 401-658-4600

Is your company or any individual who owns, manages or controls your company affiliated with any owner, designer or general contractor named above either through a business or family relationship? ☒ YES ☐ NO

Are any of the contact persons named above affiliated with your company or any individual who owns, manages or control your company, either through a business or family relationship? ☒ YES ☐ NO

If you have answered YES to either question, explain. Hart Engineering as GC

PROVIDE THE FOLLOWING REFERENCE INFORMATION FOR EACH INCOMPLETE PROJECT LISTED ON THE PREVIOUS PAGE.

PROJECT TITLE	COMPANY NAME	CONTACT PERSON	TELEPHONE
Warren	OWNER: Town of Warren	Contact Person Robert Rulli	Telephone 401-289-0529
	DESIGNER: Woodard Curran	Contact Person Jon Himlan	Telephone 781-613-0582
	GC: Hart Engineering Corp	Contact Person James Ramos	Telephone 401-658-4600
NBC Grit	OWNER: Narraganset Bay Commission	Contact Person Richard Bernier	Telephone 401-461-8848
	DESIGNER: " "	Contact Person " "	Telephone " "
	GC: Hart Engineering Corp	Contact Person James Ramos	Telephone 401-658-4600
Somerset New Equipment @ WTP & WPCF	OWNER: Town of Somerset	Contact Person Robert Bozikoski	Telephone 508-674-4215
	DESIGNER: " "	Contact Person " "	Telephone " "
	GC: Hart Engineering Corp	Contact Person James Ramos	Telephone 401-658-4600
Taunton MLPS	OWNER: City of Taunton	Contact Person Fred Cornaglia	Telephone 508-821-1431
	DESIGNER: Beta Group	Contact Person Chris Cronin	Telephone 401-333-2382
	GC: Hart Engineering Corp	Contact Person James Ramos	Telephone 401-658-4600
	OWNER:	Contact Person	Telephone
	DESIGNER:	Contact Person	Telephone
	GC:	Contact Person	Telephone
	OWNER:	Contact Person	Telephone
	DESIGNER:	Contact Person	Telephone
	GC:	Contact Person	Telephone

Is your company or any individual who owns, manages or controls your company affiliated with any owner, designer or general contractor named above either through a business or family relationship? [X] YES [ ] NO

Are any of the contact persons named above affiliated with your company or any individual who owns, manages or control your company, either through a business or family relationship? [X] YES [ ] NO

If you have answered YES to either question, explain. Hart Engineering as GC

PART 3 - PROJECT PERFORMANCE

For Parts 3 and 4, if you answer YES to any question, please provide on a separate page a complete explanation. Information you provide herein must supplement the Application for your most recently issued (not extended or amended) DCAM Certificate of Eligibility. You must report all requested information not previously reported on that DCAM Application for Prime/General Certificate of Eligibility. Include all details [project name(s) and location(s), names of all parties involved, relevant dates, etc.].

	YES	NO
1. Has your firm been terminated on any contract prior to completing a project or has any officer, partner or principal of your firm been an officer, partner or principal of another firm that was terminated or failed to complete a project?	☐	☒
2. Has your firm failed or refused either to perform or complete any of its work under any contract prior to substantial completion?	☐	☒
3. Has your firm failed or refused to complete any punch list work under any contract?	☐	☒
4. Has your firm filed for bankruptcy, or has any officer, principal or individual with a financial interest in your current firm been an officer, principal or individual with a financial interest in another firm that filed for bankruptcy?	☐	☒
5. Has your surety taken over or been asked to complete any of your work under any contract?	☐	☒
6. Has a payment or performance bond been invoked against your current firm, or has any officer, principal or individual with a financial interest in your current firm been an officer, principal or individual with a financial interest in another firm that had a payment or performance bond invoked?	☐	☒
7. Has your surety made payment to a materials supplier or other party under your payment bond on any contract?	☐	☒
8. Has any subcontractor filed a demand for direct payment with an awarding authority for a public project on any of your contracts?	☐	☒
9. Have any of your subcontractors or suppliers filed litigation to enforce a mechanic's lien against property in connection with work performed or materials supplied under any of your contracts?	☐	☒
10. Have there been any deaths of an employee or others occurring in connection with any of your projects?	☐	☒
11. Has any employee or other person suffered an injury in connection with any of your projects resulting in their inability to return to work for a period in excess of one year?	☐	☒

PART 4 - Legal or Administrative Proceedings; Compliance with Laws

Please answer the following questions. Information must supplement all judicial and administrative proceedings involving bidder's firm, which were instituted or concluded (adversely or otherwise) since your firm's Application for your most recently issued (not extended or amended) Certificate of Eligibility. You must report all requested information not previously reported on that DCAM Application for Prime/General Certificate of Eligibility.

The term "administrative proceeding" as used in this Prime/General Contractor Update Statement includes (i) any action taken or proceeding brought by a governmental agency, department or officer to enforce any law, regulation, code, legal, or contractual requirement, except for those brought in state or federal courts, or (ii) any action taken by a governmental agency, department or officer imposing penalties, fines or other sanctions for failure to comply with any such legal or contractual requirement.

The term "anyone with a financial interest in your firm" as used in this Section "I", shall mean any person and/or entity with a 5% or greater ownership interest in the applicant's firm.

If you answer YES to any question, on a separate page provide a complete explanation of each proceeding or action and any judgment, decision, fine or other sanction or result. Include all details (name of court or administrative agency, title of case or proceeding, case number, date action was commenced, date judgment or decision was entered, fines or penalties imposed, etc.).

	YES	NO
1. Have any civil, judicial or administrative proceedings involving your firm or a principal or officer or anyone with a financial interest in your firm been brought, concluded, or settled relating to the procurement or performance of any construction contract, including but not limited to actions to obtain payment brought by subcontractors, suppliers or others?	☐	☒
2. Have any criminal proceedings involving your firm or a principal or officer or anyone with a financial interest in your firm been brought, concluded, or settled relating to the procurement or performance of any construction contract including, but not limited to, any of the following offenses: fraud, graft, embezzlement, forgery, bribery, falsification or destruction of records, or receipt of stolen property?	☐	☒
3. Have any judicial or administrative proceedings involving your firm or a principal or officer or anyone with a financial interest in your firm been brought, concluded, or settled relating to a violation of any state's or federal procurement laws arising out of the submission of bids or proposals?	☐	☒
4. Have any judicial or administrative proceedings involving your firm or a principal or officer or anyone with a financial interest in your firm been brought, concluded, or settled relating to a violation of M.G.L. Chapter 268A, the State Ethics Law?	☐	☒

PART 4 - Legal or Administrative Proceedings; Compliance with Laws (continued)

	YES	NO
5. Have any judicial or administrative proceedings involving your firm or a principal or officer or anyone with a financial interest in your firm been brought, concluded, or settled relating to a violation of any state or federal law regulating hours of labor, unemployment compensation, minimum wages, prevailing wages, overtime pay, equal pay, child labor or worker's compensation?	☐	☒
6. Have any judicial or administrative proceedings involving your firm or a principal or officer or anyone with a financial interest in your firm been brought, concluded, or settled relating to a violation of any state or federal law prohibiting discrimination in employment?	☐	☒
7. Have any judicial or administrative proceedings involving your firm or a principal or officer or anyone with a financial interest in your firm been brought, concluded, or settled relating to a claim of repeated or aggravated violation of any state or federal law regulating labor relations?	☐	☒
8. Have any proceedings by a municipal, state, or federal agency been brought, concluded, or settled relating to decertification, debarment, or suspension of your firm or any principal or officer or anyone with a financial interest in your firm from public contracting?	☐	☒
9. Have any judicial or administrative proceedings involving your firm or a principal or officer or anyone with a financial interest in your firm been brought, concluded, or settled relating to a violation of state or federal law regulating the environment?	☐	☒
10. Has your firm been fined by OSHA or any other state or federal agency for violations of any laws or regulations related to occupational health or safety? Note: this information may be obtained from OSHA's Web Site at www.osha.gov	☐	☒
11. Has your firm been sanctioned for failure to achieve DBE/MBE/WBE goals, workforce goals, or failure to file certified payrolls on any public projects?	☐	☒
12. Other than previously reported in the above paragraphs of this Section I, have any administrative proceedings or investigations involving your firm or a principal or officer or anyone with a financial interest in your firm been brought, concluded, or settled by any local, state or federal agency relating to the procurement or performance of any construction contract?	☐	☒
13. Are there any other issues that you are aware which may affect your firm's responsibility and integrity as a building contractor?	☐	☒

PART 5 - SUPERVISORY PERSONNEL

List all supervisory personnel, such as project managers and superintendents, who will be assigned to the project if your firm is awarded the contract. **Attach the resume of each person listed below.**

NAME	TITLE OR FUNCTION
James Ramos	Project Manager
Gerald Lagess	Superintendent

PART 6 - CHANGES IN BUSINESS ORGANIZATION OR FINANCIAL CONDITION

Have there been any changes in your firm's business organization, financial condition or bonding capacity since the date your current Certificate of Eligibility was issued? ☐ Yes ☒ No
If YES, attach a separate page providing complete details.

PART 7 – LIST OF COMPLETED CONSTRUCTION PROJECTS SUBMITTED TO THE DIVISION OF CAPITAL ASSET MANAGEMENT.

Attach here a copy of the list of completed construction projects which was submitted with your firm's DCAM Application for your most recently issued (not extended or amended) DCAM Certificate of Eligibility. The Attachment must include a complete copy of the entire Section G – "Completed Projects" and the final page – "Certification" (Section J) containing the signature and date that the Completed Projects list (Section G) was submitted to the Division of Capital Asset Management.

James M. Ramos, P.E.
Vice President
Hart Engineering Corporation

Education:
Bachelor of Science – Civil & Environmental Engineering - University of Rhode Island
Licensed Professional Engineer – Rhode Island & Massachusetts

Summary:
Mr. Ramos joined Hart Engineering as a Project Manager in 2002. He has twenty years of managerial experience in both the design and construction of projects in the public and private sectors. His focus has been in project management associated with the construction of municipal water and wastewater treatment facilities and transport systems. He also brings to Hart extensive experience in the public utilities sector having a hands-on background in water treatment facilities and utility distribution systems.

Representative Experience with Hart Engineering:

Warwick, RI WWTP – Phosphorus Removal Upgrade & Flood Control /Mitigation Project
Project Executive on the $14.5 Million project for the construction of a Phosphorus Removal building/system; upgrades to the Headworks Building, Secondary Treatment Systems, Sludge Processing Systems and Final Clarifiers. In addition, the project includes the construction of new flood protection levee system surrounding the entire WWTP.

Rhode Island Airport Corp. – Deicer Management Treatment Facility Project
Project Executive on the $16.7 Million upgrade project on the RIAC – Deicer Management Treatment Facility Project. Work consists of the installation of an 11,000 SF WWTP facility and construction of (2) pre-cast wire wound concrete above-ground storm water/deicer storage tanks.

Mainlift Station and Headworks Upgrade – Marshfield, MA
Project Executive on the $5.4 Million upgrade project at the Marshfield WWTP. Work consists of a complete upgrade of the Main Lift PS including a temporary pumped bypass system during construction. Work at the WWTP includes the construction of new Headworks Building consisting of screenings facilities and grit removal system upgrades.

Filter Upgrade Project – Brockton, MA
Project Executive on the $3 Million upgrade project at the Brockton WWTP. Work consists of the demolition of two existing sand filters and modification to receive the installation of new cloth filters. Scope includes structural modifications, process installation and electrical integration.

Warwick, RI WWTP – Plant Reconstruction Project
Project Manager for the $11 Million WWTP re-construction project at the Warwick,RI WWTP, which involved the dewatering and reconstruction of the WWTP which was devastated from the floods of March 2009. Project included the dewatering of the entire WWTP which was under approximately 10-feet of water, establishing temporary means of primary treatment and disinfection of plant flows within days of the flood, providing temporary power to all equipment to allow for secondary treatment within weeks of the flood, while returning the plant to pre-flood effluent permit levels within months of the flood. Provided new MCCs, switchgear, generator, various motor replacements, re-construction of pumps and blowers, replacement of the I&C system, chemical storage and metering systems replacement, HVAC and plumbing replacements.

Brockton, MA – WWTP – Phase 4
Project Manager for the $7 Million Phase 4 WWTP project at the Brockton, MA WWTP. Project involved the re-construction of the Incinerator, re-construction of the Screenings Building, modifications to the aeration system, primary sludge improvements, re-construction of the plant Control room including providing new security systems, HVAC and plumbing upgrades and fire alarm additions.

Bristol, RI WWTP – Plantwide Improvements
Project Manager for a $5.4 Million upgrade project for Bristol, RI. Project included replacement of final clarifier mechanisms and gates, primary clarifier mechanisms, re-construction of the primary sludge pump station, rehabilitation of the sludge belt filter presses, installation of a new plant water system, I&C improvements, HVAC and plumbing improvements, as well as miscellaneous site improvements.

Lakeville, MA – Taunton WTP Upgrade Project
Project Manager for the $7.5 Million upgrade project at the Taunton Water Treatment Plant. Project included the addition of a fifth filter and pipe gallery; new washwater recycle tank, upgrade of existing control building, laboratory, bathrooms & conference room, replacement of existing filter media and underdrains in (4) existing filters, roof replacements, system wide surveillance system, replacement of WTP heating system and miscellaneous pump replacements.

Bristol, RI – WWTP Miscellaneous Upgrade Project
Project Manager for the $1.2 Million miscellaneous wastewater upgrade project for Bristol, RI. Project included providing new chlorination and de-chlorination systems at the WWTP, temporary sewage bypass pumping and reconstruction of (3) sewage pump stations.

Framingham, MA – Genzyme Corp. – 74 NYA - Phase 1A, B & C
Project Manager for the $5 Million relocation project for Phase 1A, 1B & 1C for Genzyme Corp. in Framingham, MA. Project included the relocation of laboratory space and office space, relocation of various building utilities to support the construction of a future pharmaceutical manufacturing facility.

Barrington, RI – WW Pump Station Project
Project Manager for the $8 Million upgrade of the 6 main wastewater pump stations in Barrington, RI. Project included temporary bypass pumping, pump replacements, comminutors, SCADA and complete electrical upgrades.

Brockton, MA – WWTP – Phase 1
Project Manager for the $15 Million Phase 1 WWTP project at the Brockton, MA WWTP. Project involved the construction of a new Primary Effluent pump station, aeration system upgrade, reconstruction of Blower building, odor control system, sludge storage tank covers, site piping, SCADA and overall plant electrical upgrade.

Mansfield, MA - Dustin & Prescott Wells WTP
Project Manager for the $5 Million Dustin & Prescott Green Sand Filter water treatment plant project. Project involved construction of 18,000 SF of administrative office space, process areas and garage space to support (6) pressure sand filters, chemical treatment systems, backwash elevated storage tank, booster pumps and wastewater handling systems.

Warwick, RI WWTP
Project Manager for the $26.5 Million Advanced Wastewater Treatment Plant Project for the City of Warwick, RI. Project involved the construction of new inlet and grit removal systems, primary clarifiers, aeration systems (including new Blower building), final clarifiers, upgrade of the overall electrical distribution system, complete SCADA upgrade, site piping and the installation of approximately 10,000 cy of reinforced concrete

Other Representative Experience:

C. B Utility Co, Inc. C Brito Construction – Bristol, RI - Vice President/ PM
Responsible for project management of various utility projects throughout New England ranging in size from $1 to 10 Million. Types of projects included: water, sewer, natural gas and drainage distribution/transmission mains. Responsibilities included bidding, procurement, scheduling and general supervision of field personnel.

Bristol County Water Authority – Bristol, RI – Engineer
Assisted with the implementation of a $50 Million Capitol Improvement Program for the Bristol County Water Authority. Responsible for coordinating the engineering and construction of the East Bay Pipeline, which consisted of the installation of 10 miles of large diameter piping, 2 river crossings(directional drill method & open cut) and 2 pumping stations.

Rhode Island Department of Transportation – Providence, RI – Engineer
Worked in the traffic engineering division. Coordinated design of traffic monitoring systems for various state projects, assisted with the implementation of the state congestion management system and I-95 Northeast Corridor Highway Operations Group.

William Rose
Project Superintendent
Hart Engineering Corporation

Summary:

Mr. Rose joined Hart in 1998 as a foreman carpenter. In 1999 he was promoted to Project Superintendent, and has held that position since then. During his nineteen years with Hart, he has been the project superintendent on many industrial facility projects and has been responsible for the on-site day-to-day supervision of safety, quality, construction, scheduling and on-site coordination. As a result of his extensive experience in the industrial sector, Mr. Rose also has an excellent working knowledge of, and extensive experience in, the supervision of mechanical, hvac, fire protection and instrumentation installations. Mr. Rose brings with him a consistent record of projects performed safely, on-time, under budget and to the highest level of client satisfaction.

Projects:

Groton Pollution Abatement Facility – Phase 1 Improvements – Groton, CT
Project Superintendent on this $4,500,000 project to demo and replace all the chain and flyte equipment in all settling tanks as well as numerous architectural, electrical, and HVAC upgrades.

Rhode Island Airport Corp. – Deicer Management Treatment Facility Project
Project Superintendent on the $16.7 Million upgrade project on the RIAC – Deicer Management Treatment Facility Project. Work consists of the installation of an 11,000 SF WWTP facility and construction of (2) pre-cast wire wound concrete above-ground storm water/deicer storage tanks.

Great Plain Avenue Pump Station – Needham, MA
Project Superintendent on this $1,600,000 project where an existing wastewater pump station was retrofitted and improved. .

Barrington, RI – WW Pump Station Project
Project Superintendent for the $8 Million upgrade of the 6 main wastewater pump stations in Barrington, RI. Project included temporary bypass pumping, pump replacements, comminutors, SCADA and complete electrical upgrades.

Brockton, MA – WWTP – Phase 1
Project Superintendent for the $15 Million Phase 1 WWTP project at the Brockton, MA WWTP. Project involved the construction of a new Primary Effluent pump station, aeration system upgrade, reconstruction of Blower building, odor control system, sludge storage tank covers, site piping, SCADA and overall plant electrical upgrade.

American Wire
Project Superintendent for the $2 million design/build structural slabs replacement project at the American Wire Facility in Pawtucket, RI. This was an extensive structural replacement project completed within an operating facility.

Westerly, WWTF
Project Superintendent for the $8 million design/build modification to the existing WWTF.

Representative Prior Experience
J.L. Marshall & Sons, Seekonk, MA
Foreman Carpenter

Company Name & DCAMM ID# ⟶			*ALL VERTICAL CONSTRUCTION PROJECTS COMPLETED OR IN PROGRESS*											
	PROJECT TITLE	**Category of Work #1 (click on arrow in cell)**	**Cost Breakdown - Category #1**	**Category of Work #2 (click on arrow in cell)**	**Cost Breakdown - Category #2**	**Category of Work #3 (click on arrow in cell)**	**Cost Breakdown - Category #3**	**Total Contract Amount**	**Contract Start Date**	**Anticipated/ Actual Completion Date**	**Percentage (%) Complete**	**PUBLIC AWARDING AUTHORITY or PRIVATE OWNER**	**Contact Person**	**Contact Email Address**
Sample Project ⟶	**Boston City Hall Renovation**	**General Building Construction**	**1200000**	**Roofing**	**400000**	**Masonry**	**200000**	**4000000**	**1/15/2008**	**5/15/2012**	**60%**	**City of Boston**	**John Smith**	**user@domain.com**
1	Philip J. Holton Purification Plant - Influent System Upgrade - 4900	General Building Construction	$ 6,837,737					$ 6,837,737	9/10/2013	12/31/2018	100.00%	Providence Water Supply Board	Leo Fontaine	lfontaine@prowater.com
2	Somerset WTP & WPCF Sodium Hypochlorite - 8200	Sewage & Water Treatment Plants	$ 1,212,571					$ 1,212,571	10/31/2016	6/30/2017	100.00%	Town of Somerset	Robert Lima	rima27351@yahoo.com
3	FieldsPoint Final Clarifier & Misc Improvements - 8000	Sewage & Water Treatment Plants	$ 3,818,738					$ 3,818,738	1/26/2017	9/1/2018	100.00%	Narragansett Bay Commission	Richard Bernier	Rbernier@narrabay.com
4	Fields Point WWTF Blower Improvements Phase II - 8400	General Building Construction	$ 2,500,000	Sewage & Water Treatment Plants	$ 5,328,500			$ 7,828,500	1/26/2017	9/1/2018	100.00%	Narragansett Bay Commission	Richard Bernier	Rbernier@narrabay.com
5	2016 Wastewater Treatment & Collection Systems Improvements Project - 8100	General Building Construction	$ 478,370	Sewage & Water Treatment Plants	$ 761,930			$ 761,930	8/25/2016	2/11/2019	100.00%	Town of New Shoreham	Chris Blane	sewer@new-shoreham.com
6	BPWWTF - Digester Pipe and Miscellaneous Improvements - 8280	General Building Construction	$ -	Sewage & Water Treatment Plants	$ 1,168,552			$ 1,168,552	5/3/2017	12/31/2018	100.00%	Narragansett Bay Commission	Richard Bernier	Rbernier@narrabay.com
7	Taunton - Sedimentation Basis and Generator Building Upgrades - 8290	General Building Construction	$ -	Sewage & Water Treatment Plants	$ 1,140,300			$ 1,140,300	4/11/2017	12/31/2018	100.00%	City of Taunton	Bill Schwartz	Bill Schwartz (bschwartz@taunton-ma.gov)
8	Philip J. Holton Purification Plant - Lime System Replacements - 8410	Sewage & Water Treatment Plants	$ 1,245,262					$ 1,245,262	6/1/2019	12/31/2019	5.00%	Providence Water Supply Board	Leo Fontaine	lfontaine@prowater.com
9	BCWA - Metacom Avenue Pump Station Upgrades - 8420	General Building Construction	$ 400,000	Pumping Stations	$ 1,480,024			$ 1,880,024	9/25/2017	5/24/2019	92.00%	Bristol County Water Authority	Pamela Marchand	pmarchand@bcwari.com
10	Replacement for 2 60' Secondary Settling Tanks at the QDC WWTP - 8440	Sewage & Water Treatment Plants	$ 415,000					$ 420,000	10/2/2017	11/30/2018	100.00%	Quonset Development Corporation	William Young	Young, William <wyoung@quonset.com>
11	Milford - Sludge Handling Facility - 8450	General Building Construction	$ 2,500,000	Sewage & Water Treatment Plants	$ 2,235,121			$ 4,735,121	5/8/2017	9/30/2019	40.00%	Town of Milford	Thomas Morelli	tmorelli@milfordwwtp.com
12	East Greenwich WWTF Upgrades - 8500	Sewage & Water Treatment Plants	$ 4,976,422					$ 4,976,422	6/14/2017	12/31/2018	100.00%	Town of East Greenwiich	Joseph Duarte	jduarte@eastgreenwichri.com
13	Phosphorus Removal and Sludge Dewatering Upgrades - 8550	Sewage & Water Treatment Plants	$ 2,702,705					$ 2,702,705	7/10/2017	3/31/2019	93.00%	Town of Southbridge	Heather Blakeley	hblakeley@southbridgemass.org
14	Southbridge WWTF - Bio-Tower Upgrade - 8600	Sewage & Water Treatment Plants	$ 1,192,473					$ 1,192,473	7/10/2017	3/31/2019	86.00%	Town of Southbridge	Heather Blakeley	hblakeley@southbridgemass.org
15	Preliminary Treatment Facility and Clarifiers, and Railroad Ave. and Pilgrim Ave Pumping	Sewage & Water Treatment Plants	$ 2,216,014	Pumping Stations	$ 3,239,080			$ 5,455,094	8/14/2017	5/1/2019	78.00%	Town of Fairhaven	Rene Robillard	rrobillard@fairhaven-ma.gov
16	Warren - 8900	Sewage & Water Treatment Plants	$ 13,787,162					$ 13,787,162	5/2/2018	12/1/2019	40.00%	Town of Warren	Robert Rulli	brulli@townofwarren-Ri.gov
17	NBC Grit - 8640	Sewage & Water Treatment Plants	$ 677,000					$ 677,000	7/16/2019	3/31/2019	71.00%	Narragansett Bay Commission	Richard Bernier	Rbernier@narrabay.com
18	Somerset New Equipment @ WTP & WPCF - 8868	Sewage & Water Treatment Plants	$ 503,300					$ 503,300	2/18/2019	9/31/19	0.00%	Town of Somerset	Robert Bozikowski	rbozikowski@gmail.com
19	Taunton MLPS - 9000	Pumping Stations	$ 7,776,000					$ 7,776,000	2/18/2019	2/31/19	0.00%	City of Taunton	Fred Cornaglia	
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GENERAL BUILDING CONSTRUCTION ONLY

FOR DCAMM CERTIFICATIO

EVALUATOR COMPANY	Evaluator Name	Evaluator Email Address	Sub-trade 1 Category	Sub-trade 1 Contract $ Amount	Sub-trade 2 Category	Sub-trade 2 Contract $ Amount	Sub-Trade 3 Category	Sub-trade 3 Contract $ Amount	Additional Notes	Contractor Number	Compliance Officer	Public
ABC Construction Management Inc.	Jane Smith	user@domain.com	Plumbing	400000	Electrical	300000	HVAC	250000				
CDR Maguire	Barry Pociask	Barry.Pociask@cdrmaguire.com	Electrical	$ 320,000	Masonry	$ 140,000	HVAC	$ 80,000				
Wright-Pierce	Chris Grillo	chris.grillo@wright-pierce.com	Electrical	$ 206,400	HVAC	$ 114,469	Masonry	$ 45,333				
Narragansett Bay Commission	Richard Bernier	rbernier@narrabay.com										
Narragansett Bay Commission	Richard Bernier	rbernier@narrabay.com	Plumbing	$ 25,000	Masonry	$ 500,000	Structural Steel	$ 250,000				
James J Geremia & Associates	James Geremia	Jim@GeremiaEngineering.com	Electrical	$ 162,550								
Narragansett Bay Commission	Richard Bernier	rbernier@narrabay.com	Electrical	$ 219,500								
Tighe & Bond, Inc.	Benjamin Levesque	bblevsque@tighebond.com	Electrical	$ 36,700	HVAC	$ 53,800	Painting	$ 51,930				
Providence Water Supply Board	Leo Fontaine	lfontaine@provwater.com	Electrical	$ 95,000								
Pare Corporation	Marc Weller	mweller@parecorp.com	Electrical	$ 204,800	Masonry	$ 45,000	HVAC	$ 48,000				
Quonset Development Corporation	William Young	Young, William <wyoung@quonset.com>	Electrical	$ 23,800								
Tata & Howard, Inc.	Meaghan Heslin	mheslin@tataandhoward.com	Electrical	$ 324,700	Masonry	$ 303,000	HVAC	$ 136,800				
Tighe & Bond, Inc.	Ian Catlow	IBCatlow@tigheBond.com	Electrical	$ 369,700	Masonry	$ 54,575	HVAC	$ 288,900				
Stantec	Justin Motta	justin.motta@stantec.com	Electrical	$ 283,970	HVAC	$ 125,000	Painting	$ 36,200				
Stantec	Justin Motta	justin.motta@stantec.com	Electrical	$ 13,000	Painting	$ 63,250						
Stantec	Justin Motta	justin.motta@stantec.com	Electrical		HVAC		Painting					
Woodard Curran	Jon Himlan	Jhimlan@woodardcurran.com	Electrical	$ 1,931,035	Painting	$ 122,800						
Narragansett Bay Commission	Richard Bernier	rbernier@narrabay.com	Painting	$ 24,031								
Town of Somerset	Robert Bozikowski	rbozikowski@gmail.com	Electrical	$ 13,200								
Beta Group	Chris Cronin	ChrisCronin@beta-inc.com										

N OFFICE USE ONLY

Private	*Who should letter go to?*	*Eval Request Letter?*

Company Name & DCAMM ID# →			*PRIME/GENERAL CONTRACTOR ALL VERTICAL CONSTRUCTION PROJECTS CURRENTLY IN PROGRESS (Do NOT input commas. You must convert to CSV)*																								
Prime/General Contractor Projects In Progress	**PROJECT TITLE**	**Category of Work #1 (click on arrow in cell)**	**Cost Breakdown - Category #1**	**Category of Work #2 (click on arrow in cell)**	**Cost Breakdown - Category #2**	**Category of Work #3 (click on arrow in cell)**	**Cost Breakdown - Category #3**	**Total Contract Amount**	**Contract Start Date**	**Anticipated Completion Date**	**Percentage (%) Complete**	**PUBLIC AWARDING AUTHORITY or PRIVATE OWNER**	**Contact Person (Mr. Ms. etc.)**	**Contact Person First Name**	**Contact Person Last Name**	**Contact Person Telephone Number**	**Contact Person Email Address**	**Street Address**	**City**	**State**	**Zip Code**	**EVALUATOR**	**(Mr. Ms. etc.)**	**Evaluator First Name**	**Evaluator Last Name**	**Evaluator Telephone**	**Evaluator Email Address**
Sample Project →	Boston City Hall Renovation	General Building Construction	1200000	Roofing	400000	Masonry	200000	4000000	1/15/2008	5/15/2012	60%	City of Boston	Mr.	John	Smith	##########	user@domain.com	123 Main Street	Boston	MA	01234	ABC Construction Management Inc.	Ms.	Jane	Jones	##########	user@domain.com
1	Philip J. Holton Purification Plant - Influent System Upgrade - 4900	General Building Construction	$ 6,837,737					$ 6,837,737	9/10/2013	12/31/2018	100.00%	Providence Water Supply Board	Mr.	Leo	Fontaine	##########	lfontaine@provwater.com	430 Scituate Avenue	Cranston	RI	02921	CDR Maguire	Mr.	Barry	Pociask	##########	Barry.Pociask@cdrmaguire.com
2	Somerset WTP & WPCF Sodium Hypochlorite - 8200	Sewage & Water Treatment Plants	$ 1,212,571					$ 1,212,571	10/31/2016	6/30/2017	100.00%	Town of Somerset	Mr.	Robert	Lima	##########	rlima27351@yahoo.com	3249 County Street	Somerset	MA	02726	Wright-Pierce	Mr.	Chris	Grillo	##########	chris.grillo@wright-pierce.com
3	FieldsPoint Final Clarifier & Misc Improvements - 8000	Sewage & Water Treatment Plants	$ 3,818,738					$ 3,818,738	1/26/2017	9/1/2018	100.00%	Narragansett Bay Commission	Mr.	Richard	Bernier	##########	Rbernier@narrabay.com	1 Service Road	Providence	RI	02905	Narragansett Bay Commission	Mr.	Richard	Bernier	##########	rbernier@narrabay.com
4	Fields Point WWTF Blower Improvements Phase II - 8400	General Building Construction	$ 2,500,000	Sewage & Water Treatment Plants	$5,328,500			$ 7,828,500	1/26/2017	9/1/2018	100.00%	Narragansett Bay Commission	Mr.	Richard	Bernier	##########	Rbernier@narrabay.com	1 Service Road	Providence	RI	02905	Narragansett Bay Commission	Mr.	Richard	Bernier	##########	rbernier@narrabay.com
5	2016 Wastewater Treatment & Collection Systems Improvements Project - 8100	General Building Construction	$ 478,370	Sewage & Water Treatment Plants	$ 761,930			$ 761,930	8/25/2016	2/11/2019	100.00%	Town of New Shoreham	Mr.	Chris	Blane	401-662-9051	sewer@new-shoreham.com	Old Town Road	Block Island	RI	02807	James J Geremia & Associates	Mr.	James	Geremia	401-454-7000	Jim@GeremiaEngineering.com
6	BPWWTF - Digester Pipe and Miscellaneous Improvements - 8280	General Building Construction	$ -	Sewage & Water Treatment Plants	$1,168,552			$ 1,168,552	5/3/2017	12/31/2018	100.00%	Narragansett Bay Commission	Mr.	Richard	Bernier	##########	Rbernier@narrabay.com	1 Service Road	Providence	RI	02905	Narragansett Bay Commission	Mr.	Richard	Bernier	##########	rbernier@narrabay.com
7	Taunton - Sedimentation Basis and Generator Building Upgrades - 8290	General Building Construction	$ -	Sewage & Water Treatment Plants	$1,140,300			$ 1,140,300	4/11/2017	12/31/2018	100.00%	City of Taunton	Mr.	Bill	Schwartz	508-947-0690	Bill Schwartz (bschwartz@taunton-ma.gov)	91 Precinct Street	Lakeville	MA	02347	Tighe & Bond, Inc.	Mr.	Benjamin	Levesque	508-471-9648	bblevesque@tighebond.com
8	Philip J. Holton Purification Plant - Lime System Replacements - 8410	Sewage & Water Treatment Plants	$ 1,245,262					$ 1,245,262	6/1/2019	12/31/2019	5.00%	Providence Water Supply Board	Mr.	Leo	Fontaine	##########	lfontaine@provwater.com	430 Scituate Avenue	Cranston	RI	02921	Providence Water Supply Board	Mr.	Leo	Fontaine	##########	lfontaine@provwater.com
9	BCWA - Metacom Avenue Pump Station Upgrades - 8420	General Building Construction	$ 400,000	Pumping Stations	$1,480,024			$ 1,880,024	9/25/2017	5/24/2019	92.00%	Bristol County Water Authority	Ms.	Pamela	Marchand	401-245-2022	pmarchand@bcwarri.com	450 Child Street	Warren	RI	02885	Pare Corporation	Mr.	Marc	Weller	401-334-4108	mweller@parecorp.com
10	Equipment & Component Replacement for 2 60' Secondary Settling Tanks at the QDC WWTP - 8440	Sewage & Water Treatment Plants	$ 415,000					$ 420,000	10/2/2017	11/30/2018	100.00%	Quonset Development Corporation	Mr.	William	Young	401-295-0044	Young, William <wyoung@quonset.com>	95 Cripe Street	North Kingston	RI	02852	Quonset Development Corporation	Mr.	William	Young	401-295-0044	Young, William <wyoung@quonset.com>
11	Milford - Sludge Handling Facility - 8450	General Building Construction	$ 2,500,000	Sewage & Water Treatment Plants	$2,235,121			$ 4,735,121	5/8/2017	9/30/2019	40.00%	Town of Milford	Mr.	Thomas	Morelli	508-473-2054	tmorelli@milfordwwtp.com	230 South Main Street	Hopedale	MA	01747	Tata & Howard, Inc.	Ms.	Meaghen	Heslin	508-303-9400	mheslin@tatahoward.com
12	East Greenwich WWTF Upgrades - 8500	Sewage & Water Treatment Plants	$ 4,976,422					$ 4,976,422	6/14/2017	12/31/2018	100.00%	Town of East Greenwich	Mr.	Joseph	Duarte	401-886-8621	jduarte@eastgreenwichri.com	111 Pierce St	East Greenwich	RI	02818	Tighe & Bond, Inc.	Mr.	Ian	Catlow	508-471-9648	IBCatlow@tighebond.com
13	Southbridge WWTF - Phosphorus Removal and Sludge Dewatering Upgrades - 8550	Sewage & Water Treatment Plants	$ 2,702,705					$ 2,702,705	7/10/2017	3/31/2019	93.00%	Town of Southbridge	Mrs.	Heather	Blakeley	508-764-5403	hblakeley@southbridgemass.org	185 Guelphwood Road	Southbridge	MA	01550	Stantec	Mr.	Justin	Motta	978-692-1913	justin.motta@stantec.com
14	Southbridge WWTF - Bio-Tower Upgrade - 8600	Sewage & Water Treatment Plants	$ 1,192,473					$ 1,192,473	7/10/2017	3/31/2019	86.00%	Town of Southbridge	Mrs.	Heather	Blakeley	508-764-5403	hblakeley@southbridgemass.org	185 Guelphwood Road	Southbridge	MA	01550	Stantec	Mr.	Justin	Motta	978-692-1913	justin.motta@stantec.com
15	Fairhaven - Upgrade to WPCF Preliminary Treatment Facility and Clarifiers, and Railroad Ave. and Pilgrim Ave Pumping Stations - 8700	Sewage & Water Treatment Plants	$ 2,216,014	Pumping Stations	$3,239,080			$ 5,455,094	8/14/2017	5/1/2019	78.00%	Town of Fairhaven	Mr.	Rene	Robillard	508-979-4030	rrobillard@fairhaven-ma.gov	5 Arsene Street	Fairhaven	MA	02719	Stantec	Mr.	Justin	Motta	978-692-1913	justin.motta@stantec.com
16	Warren - 8900	Sewage & Water Treatment Plants	$13,787,162					$13,787,162	5/2/2018	12/1/2019	40.00%	Town of Warren	Mr.	Robert	Rulli	401-289-0529	brulli@townofwarren-ri.gov	514 Main Street	Warren	RI	02885	Woodard Curran	Mr.	Jon	Himlan	781-613-0582	jhimlan@woodardcurran.com
17	NBC Grit - 8640	Sewage & Water Treatment Plants	$ 677,000					$ 677,000	7/16/2019	3/31/2019	71.00%	Narragansett Bay Commission	Mr.	Richard	Bernier	##########	Rbernier@narrabay.com	1 Service Road	Providence	RI	02905	Narragansett Bay Commission	Mr.	Richard	Bernier	##########	rbernier@narrabay.com
18	Somerset New Equipment @ WTP & WPCF - 8868	Sewage & Water Treatment Plants	$ 503,300					$ 503,300	2/18/2019	9/31/19	0.00%	Town of Somerset	Mr.	Robert	Bozikowski		rbozikowski@bmail.com	3249 County Street	Somerset	MA	02726	Town of Somerset	Mr.	Robert	Bozikowski	508-674-4215	rbozikowski@bmail.com
19	Taunton MLPS - 9000	Pumping Stations	$ 7,776,000					$ 7,776,000	2/18/2019	2/31/19	0.00%	City of Taunton	Mr.	Fred	Cornaglia	508-821-1431		90 Ingell Street	Taunton	MA	02780	Beta Group	Mr.	Chris	Cronin	401-333-2382	ChrisCronin@beta-inc.com
20																											
21																											
22																											

GENERAL BUILDING CONSTRUCTION ONLY

Evaluator Street Address	Evaluator City	State	Zip Code	Sub-trade 1 Category	Sub-trade 1 Contract $ Amount	Sub-trade 2 Category	Sub-trade 2 Contract $ Amount	Sub-Trade 3 Category	Sub-trade 3 Contract $ Amount
456 Elm Street	Anytown	MA	01567	Plumbing	$ 400,000	Electrical	$ 300,000	HVAC	$ 250,000
2080 Silas Dean Highway	Rocky Hill	CT	06067	Electrical	$ 320,000	Masonry	$ 140,000	HVAC	$ 80,000
10 Dorrance St	Providence	RI	02903	Electrical	$ 206,400	HVAC	$ 114,469	Masonry	$ 45,333
1 Service Road	Providence	RI	02905						
1 Service Road	Providence	RI	02905	Plumbing	$ 25,000	Masonry	$ 500,000	Structural Steel	$ 250,000
272 W Exchange St	Providence	RI	02903	Electrical	$ 162,550				
1 Service Road	Providence	RI	02905	Electrical	$ 219,500				
446 Main Street	Worcester	MA	01608	Electrical	$ 36,700	HVAC	$ 53,800	Painting	$ 51,930
430 Scituate Avenue	Cranston	RI	02921	Electrical	$ 95,000				
8 Blackston Valley Place	Lincoln	RI	02865	Electrical	$ 204,800	Masonry	$ 45,000	HVAC	$ 48,000
95 Cripe Street	North Kingston	RI	02852	Electrical	$ 23,800				
67 Forest Street	Marlborough	MA	01752	Electrical	$ 324,700	Masonry	$ 303,000	HVAC	$ 136,800
446 Main Street	Worcester	MA	01608	Electrical	$ 369,700	Masonry	$ 54,575	HVAC	$ 288,900
5 Burlington Woods Drive Suite 210	Burlington	MA	01803	Electrical	$ 283,970	HVAC	$ 125,000	Painting	$ 36,200
5 Burlington Woods Drive Suite 210	Burlington	MA	01803	Electrical	$ 13,000	Painting	$ 63,250		
5 Burlington Woods Drive Suite 210	Burlington	MA	01803	Electrical		HVAC		Painting	
980 Washington St	Dedham	MA	02026	Electrical	$1,931,035	Painting	$ 122,800		
1 Service Road	Providence	RI	02905	Painting	$ 24,031				
3249 County Street	Somerset	MA	02726	Electrical	$ 13,200				
6 BlackstoneValley Place	Lincoln	RI	02865						

General Building Construction	Alarm Systems	Mr.	Rachael Baglione	Yes
Alarm Systems	Asbestos Removal	Ms.	Guido Federico	No
Asbestos Removal	Deleading	Mrs.	Laura Nesci	
Electronic Security Systems	Electronic Security Systems			
Elevators	Elevators			
Fire Protection Sprinkler Systems	Finish Carpentry			
Floor Covering	Fire Protection Sprinkler Systems			
Historical Masonry	Foundations			
HVAC	Historical Painting			
Masonry	Historical Roofing			
Modular Construction/Prefab	Masonry			
Painting	Mechanical Systems			
Plumbing	Painting			
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Plumbing	Painting			
Plumbing	Painting			

7. BID BOND

KNOW ALL MEN BY THESE PRESENTS, that we:

Hart Engineering Corporation, 800 Scenic View Drive, Cumberland, RI 02864

(insert full Name and Address of Bidder)

as Principal, hereinafter called the Principal, and :

Hartford Fire Insurance Company, One Hartford Plaza, Hartford, CT 06155

(insert full Name and Address of Surety)

as Surety, a corporation duly organized under the laws of the State of Connecticut, and duly registered to conduct a surety business in Massachusetts, hereinafter called the Surety, are held and firmly bound unto CITY OF FRAMINGHAM, Framingham, Massachusetts, as Obligee, hereinafter called the Obligee, in the sum of Five Percent (5%) of the total amount bid for the payment of which sum well and truly be made, the said Principal and the said Surety, bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, the Principal has submitted a Bid for:

Edgell Road Water Pumping Station Replacement

(insert full Name of Project)

NOW, THERFORE, if the Obligee shall accept the Bid of the Principal and the Principal shall enter into a Contract with the Obligee in accordance with the terms of such Bid, and give such bonds as may be specific in the Bid Documents with good and sufficient surety for the faithful performance of such Contract and for the prompt payment of labor and materials furnished in the persecution therefore, and such other documents as may be required by the Bid Documents, then this obligation shall be null and void; but in the event of the failure of the Principal following Obligee's acceptance of Principal's Bid to enter such Contract and give such bonds within ten (10) calendar days of receipt of such Contract, or such other documents as may be required, this obligation shall remain in full force and effect, and the Surety shall pay to the Obligee the difference not to exceed the penalty hereof between the amount specified in said Bid and such larger amount for which the Obligee may in good faith contract with another party to perform the Work covered by said Bid.

POWER OF ATTORNEY

Direct Inquiries/Claims to:
THE HARTFORD
BOND, T-12
One Hartford Plaza
Hartford, Connecticut 06155
Bond.Claims@thehartford.com
call: 888-266-3488 *or fax:* 860-757-5835

KNOW ALL PERSONS BY THESE PRESENTS THAT:

Agency Name: CORMACK-ROUTHIER AGENCY, INC
Agency Code: 02-090569

- [X] **Hartford Fire Insurance Company**, a corporation duly organized under the laws of the State of Connecticut
- [X] **Hartford Casualty Insurance Company**, a corporation duly organized under the laws of the State of Indiana
- [X] **Hartford Accident and Indemnity Company**, a corporation duly organized under the laws of the State of Connecticut
- [ ] **Hartford Underwriters Insurance Company**, a corporation duly organized under the laws of the State of Connecticut
- [ ] **Twin City Fire Insurance Company**, a corporation duly organized under the laws of the State of Indiana
- [ ] **Hartford Insurance Company of Illinois**, a corporation duly organized under the laws of the State of Illinois
- [ ] **Hartford Insurance Company of the Midwest**, a corporation duly organized under the laws of the State of Indiana
- [ ] **Hartford Insurance Company of the Southeast**, a corporation duly organized under the laws of the State of Florida

having their home office in Hartford, Connecticut, (hereinafter collectively referred to as the "Companies") do hereby make, constitute and appoint, ***up to the amount of*** Unlimited :
Michael E. Bromage, Phyllis A. Nigris, James Bromage of CRANSTON, Rhode Island

their true and lawful Attorney(s)-in-Fact, each in their separate capacity if more than one is named above, to sign its name as surety(ies) only as delineated above by ☒, and to execute, seal and acknowledge any and all bonds, undertakings, contracts and other written instruments in the nature thereof, on behalf of the Companies in their business of guaranteeing the fidelity of persons, guaranteeing the performance of contracts and executing or guaranteeing bonds and undertakings required or permitted in any actions or proceedings allowed by law.

In Witness Whereof, and as authorized by a Resolution of the Board of Directors of the Companies on May 6, 2015 the Companies have caused these presents to be signed by its Senior Vice President and its corporate seals to be hereto affixed, duly attested by its Assistant Secretary. Further, pursuant to Resolution of the Board of Directors of the Companies, the Companies hereby unambiguously affirm that they are and will be bound by any mechanically applied signatures applied to this Power of Attorney.

John Gray, Assistant Secretary

M. Ross Fisher, Senior Vice President

STATE OF CONNECTICUT }
COUNTY OF HARTFORD } ss. Hartford

On this 5th day of January, 2018, before me personally came M. Ross Fisher, to me known, who being by me duly sworn, did depose and say: that he resides in the County of Hartford, State of Connecticut; that he is the Senior Vice President of the Companies, the corporations described in and which executed the above instrument; that he knows the seals of the said corporations; that the seals affixed to the said instrument are such corporate seals; that they were so affixed by authority of the Boards of Directors of said corporations and that he signed his name thereto by like authority.

CERTIFICATE

Kathleen T. Maynard
Notary Public
My Commission Expires July 31, 2021

I, the undersigned, Assistant Vice President of the Companies, DO HEREBY CERTIFY that the above and foregoing is a true and correct copy of the Power of Attorney executed by said Companies, which is still in full force effective as of 27th day of February, 2020
Signed and sealed at the City of Hartford.

Kevin Heckman, Assistant Vice President

CITY OF FRAMINGHAM
DEPARTMENT OF PUBLIC WORKS
FRAMINGHAM, MASSACHUSETTS 01702

"Dedicated to Excellence in Public Service"

PETER A. SELLERS
EXECUTIVE DIRECTOR | FDPW
BLAKE D. LUKIS
DEPUTY DIRECTOR | FDPW
WILLIAM R. SEDEWITZ - PE
CHIEF ENGINEER | FDPW
DIANE M. CONNER
ASSISTANT DIRECTOR | FDPW

BID NUMBER: PW-428 Edgell Road Pump Station Replacement
DATE: February 19, 2020
TO: Plan Holders
FROM: Ann O'Regan
SUBJECT: Addendum One (1)
BID OPENING TIME: **Thursday, March 12, 2020 at 1:00 P.M.** **(No Change)**
With reference to Invitation to Bid PW-428, please note the following information contained in this addendum:

Removal of Bid Item #3 (Saxonville Pump Station Roof Replacement):
Bid Item No. 3, Saxonville Pump Station Roof Replacement, has been removed from the PW-428 Edgell Road Pump Station Bid. **THE ATTACHED PW-428 ADDENDUM ONE PRICE SHEET MUST BE SUBMITED WITH ALL BIDS.**

Question 1: This project should not fall under the pump station exception and should be bid under Chapter 149. Sub bids should also be required for; Masonry, Roofing, Painting, Plumbing and Electrical.
Answer to Question 1: PW-428 Edgell Road Water Pumping Station Replacement is new construction and is exempt under the Pump Station exemption to c. 149, sec. 44A:

> "(D) Every contract for the construction, reconstruction, installation, demolition, maintenance or repair of any building by a public agency estimated to cost more than $150,000.00, except for a pumping station to be constructed as an integral part of a sewer construction or water construction project bid under the provisions of section 39M of chapter 30."

Question 2: Can you provide the Plan Holders List?
Answer to Question 2: The PW-428 Plan Holders List can be viewed on:
www.framinghamma.gov/dpwbids

Please sign and ***include this sheet with your bid submission*** to signify receipt of this Addendum.

By my signature below, I acknowledge receipt of the following Addenda to this proposal:

Dated 2/19/2020

Signature: _____ **Date:** 3-6-2020

CITY OF FRAMINGHAM
DEPARTMENT OF PUBLIC WORKS
FRAMINGHAM, MASSACHUSETTS 01702

"Dedicated to Excellence in Public Service"

PETER A. SELLERS
EXECUTIVE DIRECTOR | FDPW
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WILLIAM R. SEDEWITZ - PE
CHIEF ENGINEER | FDPW
DIANE M. CONNER
ASSISTANT DIRECTOR | FDPW

BID NUMBER: PW-428 Edgell Road Pump Station Replacement
DATE: March 6, 2020
TO: Plan Holders
FROM: Ann O'Regan
SUBJECT: Addendum **Two (2)**
BID OPENING TIME: **Thursday, March 12, 2020 at 1:00 P.M.** **(NO CHANGE)**

With reference to Invitation to Bid PW-428, please note the following information contained in this addendum:

A. Notes regarding removal of Saxonville Pump Station Roof from bid (deletion of documents and references).

B. Questions and Answers a provided on pages 2-5 of this addendum.

C. With reference to Bid PW-428, please refer to the following attached documents:

1. Attachment 1 – Pre-Bid Conference Minutes and Sign-In Sheet
2. Attachment 2 – Contract Drawings A-02, A-06, A-10, A-11
3. Attachment 3 – Contract Specification 06402, Interior Architectural Woodwork
4. Attachment 4 – Contract Specification 09900, Painting and Coating
5. Attachment 5 – Massachusetts Water Resources Authority (MWRA) 8(m) Permit #2430

D. All PW-428 bids must be provided on the PW-428 Addendum One Price Sheet. The Addendum One Price Sheet is also attached to this addendum.

Please sign and ***include this sheet with your bid submission*** to signify receipt of this Addendum.

By my signature below, I acknowledge receipt of the following Addenda to this proposal:

Dated 3/6/20

Signature: _____ **Date:** 3-9-20

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SECTION E: GENERAL CONDITIONS

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CITY OF FRAMINGHAM
STANDARD GENERAL CONDITIONS
OF THE CONSTRUCTION CONTRACT
M.G.L. c. 30, §39M

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GENERAL CONDITIONS

ARTICLE I – DEFINITIONS AND TERMINOLOGY

1.01 *Defined Terms*

A. Wherever used in the Contract Documents and printed with initial or all capital letters, the terms listed below will have the meanings indicated which are applicable to both the singular and plural thereof.

1. *Addenda* – Written or graphic instruments issued prior to the opening of Bids that clarify, correct, or change the Bidding Requirements or the proposed Contract Documents.

2. *Agreement* – The written instrument that is evidence of the agreement between Owner and Contractor covering the Work.

3. *Application for Payment* – The form acceptable to Owner and Engineer that is to be used by Contractor during the course of the Work in requesting progress or final payments and that is to be accompanied by such supporting documentation as is required by the Contract Documents.

4. *Asbestos* – Any material that contains more than one percent asbestos and is friable or is releasing asbestos fibers into the air above current action levels established by the United States Occupational Safety and Health Administration or the Commonwealth of Massachusetts Department of Labor Standard.

5. *Bid* – The offer of a bidder submitted on the prescribed form setting forth the prices for the Work to be performed.

6. *Bidding Documents* – The Bidding Requirements and the proposed Contract Documents including all Addenda.

7. *Bidding Requirements* – The advertisement and Invitation to Bid, Instructions to Bidders, Bid security form, Bid Form, Price Sheet, and any supplements and required forms.

8. *Change Order* – A document that is signed by Contractor and Owner and authorizes an addition, deletion, or revision in the Work or an adjustment in the Contract Price or the Contract Times, issued on or after the Effective Date of the Agreement.

9. *Claim* – A demand or assertion by Owner or Contractor seeking an adjustment of Contract Price or Contract Times, or both, or other relief with respect to the terms of the Contract. A demand for money or services by a third party is not a Claim.

10. *Contract* – The entire and integrated written agreement between the Owner and Contractor concerning the Work. The Contract supersedes prior negotiations, representations, or agreements, whether written or oral.

11. *Contract Documents* – Those items so designated in the Agreement. Only printed or hard copies of the items listed in the Agreement are Contract Documents. Approved Shop Drawings, other Contractor submittals, and the reports and drawings of subsurface and physical conditions are not Contract Documents. Files in electronic media format of text, data, graphics, and the like that may be furnished by Owner to Contractor are not Contract Documents.

12. *Contract Price* – The moneys payable by Owner to Contractor for completion of the Work in accordance with the Contract Documents as stated in the Agreement (subject to the provisions of paragraph 11.02 in the case of Unit Price Work).

13. *Contract Times* – The number of days or the dates stated in the Agreement to: (i) achieve Milestones, if any; (ii) achieve Substantial Completion; and (iii) complete the Work so that it is ready for final payment as evidenced by Engineer's written recommendation of final payment with the concurrence of the Owner.

14. *Contractor* – The individual or entity with whom Owner has entered into the Agreement.

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

16. *Effective Date of the Agreement* – The date indicated in the Agreement on which it becomes effective.

17. *Engineer* – The individual or entity appointed by the Owner to undertake the duties and powers assigned in the Contract Documents to the Engineer, acting either directly or through duly authorized representatives.

18. *Field Order* – A written order issued by Engineer or Owner that requires minor changes in the Work but that does not involve a change in the Contract Price or the Contract Times.

19. *Hazardous Environmental Condition* – The presence at the Site of Asbestos, PCBs, Petroleum, Hazardous Material, Hazardous Waste, or Radioactive Material in such quantities or circumstances that may present a substantial danger to persons or property exposed thereto.

20. *Hazardous Material* – The term Hazardous Material shall have the meaning provided in Massachusetts General Laws c. 21E as amended from time to time.

21. *Hazardous Waste* – The term Hazardous Waste shall have the meaning provided in Section 1004 of the Solid Waste Disposal Act (42 USC Section 6903) as amended from time to time.

22. *Laws and Regulations; Laws or Regulations* – Any and all applicable laws, rules, regulations, bylaws, codes, and orders of any and all governmental bodies, agencies, authorities, and courts having jurisdiction.

23. *Liens* – Charges, security interests, or encumbrances upon Project funds, real property, or personal property.

24. *Milestone* – A principal event specified in the Contract Documents relating to an intermediate completion date or time prior to completion of all the Work.

25. *Notice of Award* – The written notice by Owner to the Successful Bidder stating that upon timely compliance by the Successful Bidder with the conditions precedent listed therein, Owner, if the Owner decides to proceed with the Work, will sign and deliver the Agreement to the Successful Bidder. However, the Notice of Award shall not be construed as an agreement, meeting of the minds, contract, or any other legal obligation between the Owner and Contractor.

26. *Notice to Proceed* – A written notice given by Owner to Contractor fixing the date on which the Contract Times will commence to run and on which Contractor shall start to perform the Work.

27. *Owner* – The individual or entity with whom Contractor has entered into the Agreement and for whom the Work is to be performed.

28. *PCBs* – Polychlorinated biphenyls.

29. *Petroleum* – Petroleum, including crude oil or any fraction thereof that is liquid at standard conditions of temperature and pressure (60 degrees Fahrenheit and 14.7 pounds per square inch absolute), such as oil, petroleum, fuel oil, oil sludge, oil refuse, gasoline, kerosene, and oil mixed with other non-Hazardous Waste and crude oils.

30. *Price Sheet* – The document to be completed and submitted by Bidders in accordance with the instructions set forth in the Bidding Documents that (a) identifies various materials and items of Work that are included in the Project and the quantity estimated for each, among other information; and (b) identifies the unit price and total price at which the bidder agrees to provide or perform such materials and items.

31. *Progress Schedule* – A schedule, prepared by and maintained by Contractor, describing the sequence and duration of the activities comprising the Contractor's plan to accomplish the Work within the Contract Times.

32. *Project* – The undertaking to be performed in the Contract Documents.

33. *Project Manual* – The bound documentary information prepared for bidding and constructing the Work. A listing of the contents of the Project Manual, which may be bound in one or more volumes, is contained in the table(s) of contents.

34. *Radioactive Material* – Source, special nuclear, or byproduct material as defined by the Atomic Energy Act of 1954 (42 USC Section 2011 et seq.) as amended from time to time.

35. *Resident Project Representative* – The authorized representative of Engineer who may be assigned to the Site or any part thereof.

36. *Samples* – Physical examples of materials, equipment, or workmanship that are representative of some portion of the Work and that establish the standards by which such portion of the Work will be judged.

37. *Schedule of Submittals* – A schedule, prepared and maintained by Contractor, of required submittals and the time requirements to support scheduled performance of related construction activities.

38. *Schedule of Values* – A schedule, prepared and maintained by Contractor for lump sum portions of the Work, allocating portions of the Contract Price to various portions of the Work.

39. *Shop Drawings* – All drawings, diagrams, illustrations, schedules, and other data or information that are specifically prepared or assembled by or for Contractor and submitted by Contractor to illustrate some portion of the Work.

40. *Site* – Lands or area indicated in the Contract Documents as being furnished by Owner upon which the Work is to be performed, including rights-of-way and easements for access thereto, and such other lands furnished by Owner which are designated for the use of Contractor.

41. *Specifications* – That part of the Contract Documents consisting of written requirements for materials, equipment, systems, standards and workmanship as applied to the Work, and certain administrative requirements and procedural matters applicable thereto.

42. *Subcontractor* – An individual or entity having a direct contract with Contractor or with any other Subcontractor for the performance of a part of the Work.

43. *Substantial Completion* – The point at which either the Work has been completed except for Work having a Contract Price of less than one percent of the then adjusted total Contract Price, or substantially all of the Work has been completed and opened to public use except for minor incomplete or unsatisfactory Work items that do not materially impair the usefulness of the Work required by the Contract Documents.

44. *Successful Bidder* – The bidder submitting a responsive Bid to whom Owner makes an award.

45. *Supplementary Conditions* – The part of the Contract Documents that amends or supplements these General Conditions.

46. *Supplier* – A manufacturer, fabricator, supplier, distributor, materialman, or vendor having a direct contract with Contractor or with any Subcontractor to furnish materials or equipment to be incorporated in the Work by Contractor or any Subcontractor.

47. *Underground Facilities* – All underground pipelines, conduits, ducts, cables, wires, manholes, vaults, tanks, tunnels, or other such facilities or attachments, and any encasements containing such facilities, including those that convey electricity, gases, steam, liquid petroleum products, telephone or other communications, cable television, water, wastewater, storm water, other liquids or chemicals, or traffic or other control systems.

48. *Unit Price Work* – Work to be paid for on the basis of unit prices.

49. *Work* – The entire construction or the various separately identifiable parts thereof required to be provided under the Contract Documents. Work includes and is the result of performing or providing all labor, services, and documentation necessary to produce such construction, and furnishing, installing, and incorporating all materials and equipment into such construction, all as required by the Contract Documents.

50. *Work Change Directive* – A written statement to Contractor issued on or after the Effective Date of the Agreement and signed by Owner and recommended by Engineer ordering an addition, deletion, or revision in the Work, or responding to differing or unforeseen subsurface or physical conditions under which the Work is to be performed or to emergencies. A Work Change Directive will not change the Contract Price or the Contract Times but is evidence that the parties expect that the change ordered or documented by a Work Change Directive will be incorporated in a subsequently issued Change Order following negotiations by the parties as to its effect, if any, on the Contract Price or Contract Times.

1.02 *Terminology*

A. Intent of Certain Terms or Adjectives.

1. Whenever in the Contract Documents the terms "as allowed," "as approved," or terms of like effect or import are used, it shall be understood that the allowance or approval of the Owner is intended with the recommendation of the Engineer. Whenever in the Contract Documents the adjectives "reasonable," "suitable," "acceptable," "proper," "satisfactory," or adjectives of like effect or import are used, such adjectives shall be understood to mean approved by, acceptable to, suitable to, or satisfactory to the Owner with the recommendation of the Engineer.

2. *Day*. The word "day" shall constitute a calendar day of 24 hours measured from midnight to the next midnight.

3. *Defective.* The word "defective," when modifying the word "Work," refers to Work that is unsatisfactory, faulty, or deficient in that it:

   a. does not conform to the Contract Documents;

   b. does not meet the requirements of any applicable inspection, reference standard, test, or approval referred to in the Contract Documents;

   c. has been damaged prior to Engineer's recommendation of final payment (unless responsibility for the protection thereof has been assumed by Owner at Substantial Completion in accordance with Paragraph 14.04 or 14.05); or

   d. fails to provide the level of service for which it was intended.

4. *Furnish, Install, Perform, Provide:*

   a. The word "furnish," when used in connection with services, materials, or equipment, shall mean to supply and deliver said services, materials, or equipment to the Site (or some other specified location) ready for use or installation and in usable or operable condition.

   b. The word "install," when used in connection with services, materials, or equipment, shall mean to put into use or place in final position said services, materials, or equipment complete and ready for intended use.

   c. The words "perform" or "provide," when used in connection with services, materials, or equipment, shall mean to furnish and install said services, materials, or equipment complete and ready for intended use.

d. When "furnish," "install," "perform," or "provide" is not used in connection with services, materials, or equipment in a context clearly requiring an obligation of Contractor, "provide" is implied.

5. Unless stated otherwise in the Contract Documents, words or phrases which have a well-known technical or construction industry or trade meaning are used in the Contract Documents in accordance with such recognized meaning.

ARTICLE 2 – PRELIMINARY MATTERS

2.01 Commencement of Contract Times; Notice to Proceed: The Contract Times will commence to run on the day indicated in the Notice to Proceed. In no event will the Owner have any obligations or duties to the Contractor under the Agreement until the Notice to Proceed is given to the Contractor. Contractor has no rights or remedies arising from execution of the Agreement prior to receiving the Notice to Proceed.

2.02 Starting the Work: Contractor will start to perform the Work on the date when the Contract Times commence to run. No Work shall be done at the Site prior to the date on which the Contract Times commence to run.

2.03 *Before Starting Construction*

A. *Certificates of Insurance:* Before any Work at the Site is started, Contractor shall deliver to Owner, with a copy to Engineer, certificates of insurance (and other evidence of insurance requested by Owner) which Contractor is required to purchase and maintain in accordance with the Contract Documents.

B. *Preliminary Schedules:* Within 10 days after the Effective Date of the Agreement (unless otherwise specified in the Contract Documents), Contractor shall submit to Engineer for review:

1. a Progress Schedule in a detailed precedence-style critical path method (CPM) or primavera type format satisfactory to the Owner and the Engineer, which construction schedule also (1) provides a graphic representation of all activities and events that will occur during the performance of the Work; (2) identifies each phase of construction and occupancy; and (3) sets forth dates for completion of Milestones;

2. a preliminary Schedule of Submittals indicating the times for submitting, reviewing, and processing each required submittal; and

3. a preliminary Schedule of Values for all lump sum items of the Work that includes quantities and prices of items which, when added together, equal the Contract Price and subdivides the Work into component parts in sufficient detail to serve as the basis for progress payments during performance of the Work. Such prices will include an appropriate amount of overhead and profit applicable to each item of Work. The value of mobilization shall not exceed 5.0 percent of the Contract Price.

C. *Project "Kick-Off" Meeting; Designation of Authorized Representatives; Preconstruction Conference*

1. Within 14 days of the Effective Date of the Agreement, a project "kick-off" meeting attended by Owner, Contractor, Engineer, and others as appropriate will be held to establish a working understanding among the parties as to the Work and to discuss the schedules referred to in Paragraph 2.03.B, procedures for handling Shop Drawings and other submittals, processing Applications for Payment, and maintaining required records.

2. At this project kick-off meeting Owner and Contractor each shall designate, in writing, a specific individual to act as its authorized representative with respect to the services and responsibilities under the Contract. To the extent permitted by law, such individuals shall have the authority to transmit instructions, receive information, render decisions relative to the Contract, and otherwise act on behalf of each respective party.

3. No later than one week prior to the commencement of Work, the Owner, Engineer, Contractor and other applicable parties shall hold a preconstruction conference.

D. *Initial Acceptance of Schedules:* At the project kick-off meeting, the parties will review for acceptability to Owner and Engineer as provided below the schedules submitted in accordance with paragraph 2.03.B. Upon review and acceptance by the Owner and the Engineer of the Progress Schedule and Schedule of Values, each shall be deemed part of the Contract Documents and attached to the agreement as an Exhibit. If not accepted, the schedules shall be promptly revised by the Contractor in accordance with the recommendation of the Owner and the Engineer and resubmitted within seven days for acceptance. The Contractor shall not commence Work until the Owner and the Engineer have approved all schedules and Shop Drawings required under this Article and a preconstruction conference is held. The Owner's and Engineer's acceptance of any such schedules and Shop Drawings shall not relieve Contractor from Contractor's full responsibility for compliance with the Contract Documents.

2.04 Contractor's Review of Contract Documents: The grades, elevations, dimensions, locations, and field measurements or any drawings or specifications issued by the Engineer, or the Work installed by other Contractors, are not guaranteed by the Engineer or the Owner. The Contractor shall verify the accuracy of all grades, elevations, dimensions, locations and field measurements. In all cases of the interconnection of its Work with existing or other Work, the Contractor shall verify at the Site all dimensions relating to such existing or other Work. Any errors due to the Contractor's failure to verify all such grades, elevations, dimensions, locations, or field measurements shall be promptly rectified by the Contractor without any additional costs to the Owner or extensions of Contract Times.

ARTICLE 3 – CONTRACT DOCUMENT: INTENT, AMENDING, REUSE

3.01 *Intent*

A. The Contract Documents are complementary; what is called for by one is as binding as if called for by all.

B. It is the intent of the Contract Documents to describe a functionally complete Project (or part thereof) to be constructed in accordance with the Contract Documents. Any labor, documentation, services, materials, or equipment that may reasonably be inferred from the Contract Documents or from prevailing custom or trade usage as being required to produce the intended result will be provided whether or not specifically called for at no additional cost to Owner.

C. Each and every provision of law and clause required by law to be inserted in the Contract Documents shall be deemed to be inserted herein, and the Contract Documents shall be read and enforced as though they were included herein.

D. Clarifications and interpretations of the Contract Documents shall be issued by Engineer as provided in Article 9.

3.02 *Reference Standards*

A. *Standards, Specifications, Codes, Laws, and Regulations*

1. Reference to standards, specifications, manuals, or codes of any technical society, organization, or association, or to Laws or Regulations, whether such reference be specific or by implication, shall mean the standard, specification, manual, code, or Laws or Regulations in effect at the time of opening of Bids, except as may be otherwise specifically stated in the Contract Documents or required by law.

2. No provision of any such standard, specification, manual, or code, or any instruction of a Supplier, shall be effective to change the duties or responsibilities of Owner, Contractor, or Engineer, or any of their subcontractors, consultants, agents, or employees, from those set forth in the Contract Documents. No such provision or instruction shall be effective to assign to Owner, Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, any duty or authority to supervise or direct the performance of the Work or any duty or any duty or authority to undertake responsibility inconsistent with the provisions of the Contract Documents.

3.03 *Reporting and Resolving Discrepancies*

A. *Reporting Discrepancies*

1. *Contractor's Review of Contract Documents Before Starting Work:* Before undertaking each part of the Work, Contractor shall carefully study and compare the Contract Documents and check and verify pertinent figures therein and all applicable field measurements. Contractor shall promptly report in writing to Engineer any conflict, error, ambiguity, or discrepancy that Contractor may discover and shall obtain a written interpretation or clarification from Engineer before proceeding with any Work affected thereby.

2. *Contractor's Review of Contract Documents During Performance of Work:* If, during the performance of the Work, Contractor discovers any conflict, error, ambiguity, or discrepancy within the Contract Documents, or between the Contract Documents and (a) any applicable Law or Regulation, (b) any standard, specification, manual, or code, or (c) any instruction of any Supplier, then Contractor shall promptly report it to Engineer in writing. Contractor shall not proceed with the Work affected thereby (except in an emergency as required by Paragraph 6.16) until an amendment or supplement to the Contract Documents has been issued by one of the methods indicated in Paragraph 3.04.

B. *Resolving Discrepancies*

1. Except as may be otherwise specifically stated in the Contract Documents, the provisions of the Contract Documents shall take precedence in resolving any conflict, error, ambiguity, or discrepancy between the provisions of the Contract Documents and:

a. the provisions of any standard, specification, manual, or code, or the instruction of any Supplier (whether or not specifically incorporated by reference in the Contract Documents); or

b. the provisions of any Laws or Regulations applicable to performance of the Work (unless such an interpretation of the provisions of the Contract Documents would result in violation of such Law or Regulation).

3.04 *Amending and Supplementing Contract Documents*

A. The Contract Documents can only be amended to provide for additions, deletions, and revisions in the Work or to modify the terms and conditions thereof by either a written Change Order or a written Work Change Directive.

B. The requirements of the Contract Documents may be supplemented, and minor variations and deviations in the Work may be authorized, by one or more of the following ways:

1. A Field Order;

2. Engineer's approval of a Shop Drawing or Sample (subject to the provisions of Paragraph 6.17.D.3); or

3. Engineer's written interpretation or clarification.

C. Any variations and deviations in the Work arising from any of the methods set forth in Paragraph 3.04.B will not authorize any Amendment to the Contract Price or Contract Times. The sole method to amend the Contract Price or Contract Times is pursuant to Paragraph 3.04.A.

3.05 *Reuse of Documents*

A. Contractor and any Subcontractor or Supplier shall not:

1. have or acquire any title to or ownership rights in any of the Drawings, Specifications, or other documents (or copies of any thereof) prepared by or bearing the seal of Engineer or its consultants, including electronic media editions; or

2. reuse any such Drawings, Specifications, other documents, or copies thereof on extensions of the Project or any other project without written consent of Owner and Engineer and specific written verification or adaptation by Engineer.

B. The prohibitions of this Paragraph 3.05 will survive final payment, or termination of the Contract. Nothing herein shall preclude Contractor from retaining copies of the Contract Documents for record purposes.

3.06 *Electronic Data*

A. The data furnished by Owner or Engineer to Contractor, or by Contractor to Owner or Engineer, that may be relied upon are limited to the printed copies (also known as hard copies). Files in electronic media format of text, data, graphics, or other types are furnished only for the convenience of the receiving party. Any conclusion or information obtained or derived from such electronic files will be at the user's sole risk. If there is a discrepancy between the electronic files and the hard copies, the hard copies govern.

B. Because data stored in electronic media format can deteriorate or be modified inadvertently or otherwise without authorization of the data's creator, the party receiving electronic files agrees that it will perform acceptance tests or procedures within 60 days, after which the receiving party shall be deemed to have accepted the data thus transferred. Any errors detected within the 60-day acceptance period will be corrected by the transferring party.

C. When transferring documents in electronic media format, the transferring party makes no representations as to long term compatibility, usability, or readability of documents

resulting from the use of software application packages, operating systems, or computer hardware differing from those used by the data's creator.

ARTICLE 4 – AVAILABILITY OF LANDS; SUBSURFACE PHYSICAL CONDITIONS; HAZARDOUS ENVIRONMENTAL CONDITIONS; REFERENCE POINTS

4.01 *Availability of Lands*

A. Owner shall furnish the Site. Owner shall notify Contractor of any encumbrances or restrictions not of general application but specifically related to use of the Site with which Contractor must comply in performing the Work. Owner will obtain easements or other permissions for permanent structures or permanent changes in existing facilities. Except as otherwise provided, the Contractor shall obtain any and all other permits required in the performance of the Work, including without limitation any street opening permits, blasting permits, permits required by any State or Federal agencies, permits required under Article 6.08 hereof, and any other permits.

B. The Owner shall provide space at 229 Arthur Street in Framingham for the temporary storage of asbestos containing material. This is the only permitted temporary asbestos storage location.

C. With the exception of temporary asbestos storage under Article 4.01B, Contractor shall provide for all additional lands and access thereto that may be required for temporary construction facilities or storage of materials and equipment and shall comply with all applicable laws, regulations, permit conditions, and contractual requirements in connection therewith.

4.02 *Subsurface and Physical Conditions*: The Owner makes no representations as to reports or explorations or tests of subsurface conditions at or contiguous to the Site.

4.03 *Differing Subsurface or Physical Conditions:*

A. If, during the progress of the Work, the Contractor or Owner discovers that the actual subsurface or latent physical conditions encountered at the Site differ substantially or materially from those shown on the Drawings or indicated in the Contract Documents, either the Contractor or Owner may request an equitable adjustment in the Contract Price of the Contract applying to Work affected by the differing site conditions. A request for such an adjustment shall be made 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. Upon receipt of such a Claim from Contractor, or upon its own initiative, Owner shall make an investigation of such physical conditions, and, if they differ substantially or materially from those shown on the Drawings 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 Drawings and Contract Documents and are of such a 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 make an equitable adjustment in the Contract Price, and the Contract shall be modified in writing accordingly. The Contractor and each Subcontractor shall evaluate and satisfy themselves as to the site conditions and limitations under which the Work is to be performed, including, without limitation, (1) the location, condition, layout, and nature of the project site and surrounding areas; (2) generally prevailing climatic conditions; (3) anticipated labor, supply, and costs; (4) availability and cost of materials, tools, and equipment; and (5) other similar issues. The Owner assumes no responsibility or liability for the physical condition or safety of the project site or any improvement located on the project site. Except as set forth in Article 4, the Contractor shall be solely responsible for providing a safe place for the performance of the Work. The Owner shall not be required to make adjustments in either the Contract Price or Contract Times arising from a failure by the Contractor or any Subcontractor to comply with the requirements of this Paragraph.

B. If Contractor discovers or should have discovered that any subsurface or physical condition at or contiguous to the Site that is uncovered or revealed either:

1. is of such a nature as to establish that any "technical data" on which Contractor is entitled to rely is materially inaccurate; or

2. is of such a nature as to require a change in the Contract Documents; or

3. differs substantially or materially from that shown on the Drawings 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 Drawings and Contract Documents;

then Contractor shall, immediately or not more than 24 hours after the time the Contractor discovers or should have discovered and before further disturbing the subsurface or physical conditions or performing any Work in connection therewith (except in an emergency as provided in Paragraph 6.16), notify Owner and Engineer in writing about such condition. Contractor shall not further disturb such condition or perform any Work in connection therewith (except as aforesaid) until receipt of a written order to do so. Such notice shall constitute a Claim as defined in the Contract Documents and shall be subject to the procedures set forth in Paragraph 10.05.

C. Except as otherwise provided herein or by law, Contractor shall bear all costs, expenses, losses, and damages on account of the quantity or character of the Work or the nature of the land in or under or on which the Work is done being different from that indicated or shown in the Contract Documents or from what was estimated or expected, or on account of the weather, elements, or other causes. Contractor shall not be entitled to any adjustment in the Contract Price or Contract Times if:

1. Contractor knew of the existence of such conditions at the time Contractor made a final commitment to Owner in respect of Contract Price and Contract Times by the submission of a Bid or becoming bound under the Agreement; or

2. The existence of such condition could reasonably have been discovered or revealed as a result of any examination, investigation, exploration, test, or study of the Site and contiguous areas required by the Bidding Requirements or Contract Documents to be conducted by or for Contractor prior to Contractor's making such final commitment; or

3. Contractor failed to follow the procedures outlined in this Paragraph or in Paragraph 10.05.

4.04 *Underground Facilities*

A. The information and data shown or indicated in the Contract Documents with respect to existing Underground Facilities at or contiguous to the Site is based on information and data furnished to Owner or Engineer by the owners of such Underground Facilities, including Owner, or by others. Owner shall not be responsible for the accuracy or completeness of any such information or data provided by others.

B. The cost of all of the following will be included in the Contract Price, and Contractor shall have full responsibility for:

1. reviewing and checking all such information and data;

2. locating all Underground Facilities shown or indicated in the Contract Documents;

3. coordination of the Work with the owners of such Underground Facilities, including Owner, during construction; and

4. the safety and protection of all such Underground Facilities and repairing any damage thereto resulting from the Work.

C. *Not Shown or Indicated*

1. If an Underground Facility is uncovered or revealed at or contiguous to the Site which was not shown or indicated, or not shown or indicated with reasonable accuracy in the Contract Documents, Contractor shall, within 24 hours after the Contractor discovered or should have discovered thereof and before further disturbing conditions affected thereby or performing any Work in connection therewith (except in an emergency as required by Paragraph 6.16), identify the owner of such Underground Facility and give written notice to that owner and to Owner and Engineer. Engineer will promptly review the Underground Facility and determine the extent, if any, to which a change is required in the Contract Documents to reflect and document the consequences of the existence or location of the Underground Facility. During such

time, Contractor shall be responsible for the safety and protection of such Underground Facility.

2. If Engineer concludes that a change in the Contract Documents is required, a Work Change Directive or a Change Order will be issued to reflect and document such consequences. An equitable adjustment shall be made in the Contract Price or Contract Times, or both, to the extent that they are attributable to the existence or location of any Underground Facility that was not shown or indicated or not shown or indicated with reasonable accuracy in the Contract Documents and that Contractor did not know of and could not reasonably have been expected to be aware of or to have anticipated. If Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any such adjustment in Contract Price or Contract Times, Owner or Contractor may make a Claim therefor as provided in Paragraph 10.05.

4.05 *Reference Points*

A. Engineer shall provide engineering surveys to establish reference points for construction which in Engineer's judgment are necessary to enable Contractor to proceed with the Work. Contractor shall be responsible for laying out the Work, shall protect and preserve the established reference points and property monuments, and shall make no changes or relocations without the prior written approval of Owner. Contractor shall report to Engineer whenever any reference point or property monument is lost or destroyed or requires relocation because of necessary changes in grades or locations, and shall be responsible for the accurate placement or relocation of such reference points or property monuments by professionally qualified personnel.

B. Engineer may check the lines, elevations, reference marks, batter boards, etc., set by Contractor, and Contractor shall correct any errors revealed by such check. Such a check shall not be considered an approval of Contractor's work and shall not relieve Contractor of the responsibility for accurate consideration of the entire Work. Contractor shall furnish personnel to assist Engineer in checking lines and grades.

4.06 *Hazardous Environmental Condition at Site*

A. *Reports and Drawings:* The Supplementary Conditions identify those reports and drawings known to Owner relating to Hazardous Environmental Conditions that have been identified at the Site.

B. Contractor may rely upon the accuracy of the "technical data" contained in such reports and drawings, but such reports and drawings are not Contract Documents. Such "technical data" is identified in the Supplementary Conditions. Except for such reliance on such "technical data," Contractor may not rely upon or make any claim against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors with respect to:

1. the completeness of such reports and drawings for Contractor's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences, and procedures of construction to be employed by Contractor and safety precautions and programs incident thereto; or

2. other data, interpretations, opinions, and information contained in such reports or shown or indicated in such drawings; or

3. any Contractor interpretation of or conclusion drawn from any "technical data" or any such other data, interpretations, opinions, or information.

C. The Contractor must take all precautions to discover and locate any Hazardous Environmental Condition(s) at the site that may present a substantial danger to persons or property exposed thereto in connection with the Work at the site. The Contractor is responsible for any damages caused by such Hazardous Environmental Condition(s) created on the Site, or created with any materials brought to the Site, by a Contractor, Subcontractor, Supplier, or anyone else for whom Contractor is responsible. Within 24 hours of the time when the Contractor discovers the Hazardous Environmental Condition(s), the Contractor will follow the procedures set forth in Article 4.06.D.

D. If Contractor encounters a Hazardous Environmental Condition or if Contractor or anyone for whom Contractor is responsible creates a Hazardous Environmental Condition, Contractor shall immediately: (i) secure or otherwise isolate such condition; (ii) stop all Work in connection with such condition and in any area affected thereby (except in an emergency as required by Paragraph 6.16.A); and (iii) notify Owner and Engineer (and promptly thereafter confirm such notice in writing). Owner shall consult with Engineer concerning the necessity for Owner to retain a qualified expert to evaluate such condition or take corrective action, if any. After consulting with Engineer, Owner shall take such actions as are necessary to permit Owner or Contractor to timely obtain required permits and provide Contractor the written notice required by Paragraph 4.06.E.

E. Contractor shall not resume Work in connection with such condition or in any affected area until after Owner or Contractor has obtained any required permits related thereto and the Engineer has delivered written notice to Contractor: (i) specifying that such condition and any affected area is or has been rendered safe for the resumption of Work; or (ii) specifying any special conditions under which such Work may be resumed safely. If Owner and Contractor cannot agree as to entitlement to or on the amount or extent, if any, of any adjustment in Contract Price or Contract Times, or both, as a result of such Work stoppage or any special conditions under which Work is agreed to be resumed by Contractor, either party may make a Claim therefor as provided in Paragraph 10.05.

F. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or other

dispute resolution costs) arising out of or relating to a Hazardous Environmental Condition created by Contractor or by anyone for whom Contractor is responsible.

G. The provisions of Paragraphs 4.02, 4.03, and 4.04 do not apply to a Hazardous Environmental Condition uncovered or revealed at the Site.

ARTICLE 5 – BONDS AND INSURANCE

5.01 *Performance, Payment, and Other Bonds*

A. Contractor shall furnish performance and payment bonds in an amount acceptable to the Owner and as required by Article 9 of the Short Form of Agreement for Construction as security for the faithful performance and payment of all of Contractor's obligations under the Contract Documents. These bonds shall remain in effect until one year after the date when final payment becomes due or until completion of the correction period specified in Paragraph 13.07, whichever is later, except as provided otherwise by Laws or Regulations or by the Contract Documents. Contractor shall also furnish such other bonds as are required by the Contract Documents.

B. All bonds shall be in the form prescribed by the Contract Documents except as provided otherwise by Laws or Regulations, shall be executed by such sureties as are qualified to do business in the Commonwealth of Massachusetts and as are acceptable to the Owner. Sureties must be rated B+ or better by A.M. Best Company or rated A or better by Standard & Poors. All bonds signed by an agent or attorney-in-fact must be accompanied by a certified copy of that individual's authority to bind the surety. The evidence of authority shall show that it is effective on the date the agent or attorney-in-fact signed each bond.

C. If the surety on any bond furnished by Contractor is declared bankrupt or becomes insolvent or its right to do business is terminated in any state where any part of the Project is located or it ceases to meet the requirements of Paragraph 5.01.B, Contractor shall promptly notify Owner and Engineer and shall, within 20 days after the event giving rise to such notification, provide another bond and surety, both of which shall comply with the requirements of Paragraphs 5.01.B and 5.02.

5.02 *Licensed Sureties and Insurers*

A. All bonds and insurance required by the Contract Documents to be purchased and maintained by Owner and Contractor shall be obtained from surety or insurance companies that are duly licensed or authorized in Massachusetts to issue bonds or insurance policies for the limits and coverages so required.

5.03 *Certificates of Insurance*

A. Contractor shall deliver to Owner, with copies to each additional insured and loss payee identified in the Supplementary Conditions, certificates of insurance (and other evidence of insurance requested by Owner or any other additional insured) which Contractor is required to purchase and maintain.

B. Owner does not represent that insurance coverage and limits established in this Contract necessarily will be adequate to protect Contractor.

C. The insurance and insurance limits required herein shall not be deemed as a limitation on Contractor's liability under the indemnities granted to Owner in the Contract Documents.

5.04 *Contractor's Insurance*: Contractor and its Subcontractors, consultants, and other parties performing or furnishing any portion of the Work shall purchase and maintain insurance as required by Article 10 of the Short Form of Agreement for Construction.

5.05 *Acceptance of Bonds and Insurance; Option to Replace*

A. If Owner has any objection to the coverage afforded by or other provisions of the bonds or insurance required to be purchased and maintained by the Contractor in accordance with Article 5 on the basis of non-conformance with the Contract Documents, Owner shall so notify Contractor in writing within 10 days after receipt of the certificates (or other evidence requested) required by Paragraph 2.03.A. Contractor shall provide to Owner such additional information in respect of insurance provided as Owner may reasonably request. However, failure of Owner to demand such certificates or other evidence of Contractor's full compliance with these insurance requirements or failure of Owner to identify a deficiency in compliance from the evidence provided shall not be construed as a waiver of Contractor's obligation to maintain such insurance. If Contractor does not purchase or maintain all of the bonds and insurance required of Contractor by the Contract Documents, Contractor shall notify Owner in writing of such failure to purchase prior to the start of the Work, or of such failure to maintain prior to any change in the required coverage. Without prejudice to any other right or remedy, Owner may elect to obtain equivalent bonds or insurance to protect Owner's interests at the expense of Contractor and a Change Order shall be issued to reduce the Contract Price accordingly.

ARTICLE 6 – CONTRACTOR'S RESPONSIBILITIES

6.01 *Supervision and Superintendence*

A. Contractor shall supervise, inspect, and direct the Work competently and efficiently, devoting such attention thereto and applying such skills and expertise as may be necessary to perform the Work in accordance with the Contract Documents. Contractor shall be solely responsible for the means, methods, techniques, sequences, and procedures of construction.

B. At all times during the progress of the Work, Contractor shall assign a competent resident superintendent who shall not be replaced without written notice to Owner and Engineer except under extraordinary circumstances. The superintendent will be Contractor's representative at the Site and shall have authority to act on behalf of Contractor for purposes included but not limited to giving or receiving notices, Change Orders, or any other information from Engineer or Owner to Contractor. All communications given to or received from the superintendent shall be binding on Contractor. If the superintendent is not present on the job site during normal working hours for any consecutive 48-hour period, Contractor shall in writing addressed to Engineer and Owner identify the individual who is acting as superintendent.

6.02 *Labor; Working Hours*

A. Contractor shall provide competent, suitably qualified personnel to survey and lay out the Work and perform construction as required by the Contract Documents. Contractor shall at all times maintain good discipline and order at the Site.

B. Except as otherwise required for the safety or protection of persons or the Work or property at the Site or adjacent thereto, and except as otherwise stated in the Contract Documents, all Work at the Site shall be performed during regular working hours. Contractor will not permit the performance of Work on a Saturday, Sunday, or any legal holiday without Owner's written consent given after prior written notice to Engineer.

C. Regular working hours are defined as 8 hours per day, Monday through Friday, excluding federal and state holidays, between the hours of 7:00 AM and 5:00 PM. The Contractor shall also abide by work hour restrictions set forth in or required under permits obtained by the Contractor or Owner in connection with the Project. Requests to work other than regular working hours shall be submitted to Engineer not less than 48 hours prior to any proposed weekend work or scheduled extended work weeks. Occasional unscheduled overtime may be permitted provided two hours' notice is given to Engineer.

D. Contractor shall reimburse Owner for additional engineering and/or inspection costs incurred as a result of overtime work in excess of the regular working hours stipulated in Paragraph 6.02.C. At Owner's option, overtime costs may either be deducted from Contractor's monthly payment request or deducted from Contractor's retention prior to release of final payment. Overtime costs for Owner's personnel shall be based on the individual's current overtime wage rate. Overtime costs for personnel employed by Engineer or Owner's independent testing laboratory shall be calculated in accordance with the terms of their respective contracts with Owner.

E. This Agreement is subject to the applicable provisions of the Contract Work Hours and Safety Standards Act, Public Law 87-581, 87th Congress. No Contractor or Subcontractor shall require or permit any laborer or mechanic to be employed on the Work in excess of forty hours in any work week unless such laborer or mechanic receives

compensation at a rate not less than one and one-half times that person's basic rate of pay for all hours worked in excess of forty hours in such work week.

F. Contractor shall pay the prevailing wage and comply with all provisions of Mass. Gen. L. Ch. 149, Sec. 26 – 27D and in the publication of Minimum Wage Rates issued by the Commonwealth of Massachusetts Division of Occupational Safety (DOS), and a Statement of Compliance shall be included in the Contract Documents. Pursuant to Mass. Gen. L. Ch. 149, Sec. 26 and 27B, the Contractor (and every subcontractor) shall file weekly certified payroll records with the Owner for all employees who have worked on the Project. Contractor shall include the completed Statement of Compliance and Weekly Payroll Report Forms with its draft and final Applications for Payment for applicable labor classifications as required by DOS. The Owner and the Contractor shall preserve said records for a period of not less than three years from the date of completion of the Contract. Minimum prevailing wage rates to be used for this Contract are shown in the Bidding Documents. If Contractor, during the duration of this Contract, requires a minimum wage rate for some additional classification, a Contractor shall submit a request to the Owner, who in turn will obtain additional classifications and corresponding minimum wage rates from the DOS and advise Contractor of the same.

G. Contractor shall employ only sufficiently trained and competent persons to do the Work. Whenever Owner shall notify Contractor in writing that any person employed on the Work appears to be incompetent, disorderly, or otherwise unsatisfactory, such person shall be removed from the Project within twenty-four (24) hours following Contractor's receipt of such notice and shall not again be employed on it except with the consent of Owner.

H. Contractor shall provide adequate contract orientation for all staff to be assigned on a permanent, temporary, or call-in basis. This shall include familiarization of equipment type and the respective locations of Work. All Contractor and subcontractor staff involved in the Work must be familiar with their contractual responsibilities pertaining to security, safety, inspection guidelines, and activities around all Work locations.

6.03 *Services, Materials, and Equipment*

A. Unless otherwise provided in the Contract Documents, Contractor shall provide and assume full responsibility for all services, materials, equipment, labor, transportation, construction equipment and machinery, tools, appliances, fuel, power, light, heat, telephone, water, sanitary facilities, temporary facilities, and all other facilities and incidentals necessary for the performance, testing, start-up, and completion of the Work.

B. All materials and equipment incorporated into the Work shall be as specified or, if not specified, shall be of good quality and new, except as otherwise provided in the Contract Documents. All special warranties and guarantees required by the Specifications shall expressly run to the benefit of Owner. If required by Owner or Engineer, Contractor shall furnish satisfactory evidence (including reports of required tests) as to the source, kind, and quality of materials and equipment. The Contractor agrees to assign to the

Owner at the time of final completion of the Work any and all manufacturer's warranties relating to materials and labor used in the Work, and the Contractor further agrees to perform the Work in such a manner to preserve any and all manufacturer's warranties.

C. All materials and equipment shall be stored, applied, installed, connected, erected, protected, used, cleaned, and conditioned in accordance with instructions of the applicable Supplier, except as otherwise may be provided in the Contract Documents.

Materials not conforming to the Contract Documents shall be rejected or removed from the Site by the Contractor as directed. No rejected material, the defects of which have been subsequently corrected, shall be used except with the permission of the Owner. Should the Contractor fail to remove defective material within the time indicated in writing, the Owner shall remove and replace the defective material, and the cost of such removal and replacement will be deducted from any monies due or to become due to the Contractor or be reimbursed to the Owner by the Contractor.

6.04 *Progress Schedule*

A. Contractor shall adhere to the Progress Schedule established in accordance with Paragraph 2.03 as it may be adjusted from time to time as provided below.

1. Contractor shall submit to Engineer for acceptance (to the extent indicated in Paragraph 2.03) proposed adjustments in the Progress Schedule that will not result in changing the Contract Times. Such adjustments will comply with any provisions of the Specifications applicable thereto.

2. Proposed adjustments in the Progress Schedule that will change the Contract Times shall be submitted in accordance with the requirements of Paragraph 12.02. Adjustments in Contract Times may only be made by a Change Order.

6.05 *Substitutes and "Or-Equals"(also called "Or Approved Equals")*

A. Whenever an item of material or equipment is specified or described in the Contract Documents by using the name of a proprietary item or the name of a particular Supplier, the specification or description is intended to establish the type, function, appearance, and quality required. Unless the specification or description contains or is followed by words reading that no like, equivalent, or "or-equal" item or no substitution is permitted, other items of material or equipment or material or equipment of other Suppliers may be submitted to Engineer for review under the circumstances described below.

1. *"Or-Equal" Items:* If in the Owner's and Engineer's discretion an item of material or equipment proposed by Contractor is functionally equal to that named and sufficiently similar so that no change in related Work will be required, it may be considered by Engineer as an "or-equal" item, in which case review and approval of the proposed item may, in the Owner's and Engineer's discretion, be accomplished

without compliance with some or all of the requirements for approval of proposed substitute items. For the purposes of this Paragraph 6.05.A.1, a proposed item of material or equipment will be considered functionally equal to an item so named if:

a. in the exercise of reasonable judgment the Owner and Engineer determine that:

i. it is at least equal in materials of construction, quality, durability, appearance, strength, and design characteristics;

ii. it will reliably perform at least equally well the function and achieve the results imposed by the design concept of the completed Project as a functioning whole; and

iii. it has a proven record of performance and availability of responsive service.

b. Contractor certifies that, if approved and incorporated into the Work:

i. there will be no increase in cost to the Owner or increase in Contract Times; and

ii. it will conform substantially to the detailed requirements of the item named in the Contract Documents.

2. *Substitute Items:*

a. If in the Owner's and Engineer's discretion an item of material or equipment proposed by Contractor does not qualify as an "or-equal" item under Paragraph 6.05.A.1, it will be considered a proposed substitute item.

b. Contractor shall submit sufficient information as provided below to allow Engineer to determine if the item of material or equipment proposed is essentially equivalent to that named and an acceptable substitute therefor. Requests for review for proposed substitute items of material or equipment will not be accepted by Engineer from anyone other than Contractor.

c. The requirements for review by Engineer will be as set forth in Paragraph 6.05.A.2.d, as supplemented by the Specifications, and as Engineer may decide is appropriate under the circumstances.

d. Contractor shall make written application to Engineer for review of a proposed substitute item of material or equipment that Contractor seeks to furnish or use. The application:

i. shall certify that the proposed substitute item will:

A) perform adequately the functions and achieve the results called for by the general design,

B) be similar in substance to that specified, and

C) be suited to the same use as that specified;

ii. will state:

A) the extent, if any, to which the use of the proposed substitute item will prejudice Contractor's achievement of Substantial Completion on time,

B) whether use of the proposed substitute item in the Work will require a change in any of the Contract Documents (or in the provisions of any other direct contract with Owner for other work on the Project) to adapt the design to the proposed substitute item, and

C) whether incorporation or use of the proposed substitute item in connection with the Work is subject to payment of any license fee or royalty;

iii. will identify:

A) all variations of the proposed substitute item from that specified, and

B) available engineering, sales, maintenance, repair, and replacement services; and

C) shall contain an itemized estimate of all costs or credits that will result directly or indirectly from use of such substitute item, including costs of redesign and claims of other contractors affected by any resulting change.

B. *Substitute Construction Methods or Procedures:* If a specific means, method, technique, sequence, or procedure of construction is expressly required by the Contract Documents, Contractor may furnish or utilize a substitute means, method, technique, sequence, or procedure of construction approved by Engineer. Contractor shall submit sufficient information to allow the Owner and Engineer, in their discretion, to determine that the substitute proposed is equivalent to that expressly called for by the Contract Documents. The requirements for review by Engineer will be similar to those provided in Paragraph 6.05.A.2.

C. *Engineer's Evaluation:* Engineer will be allowed seven days within which to evaluate each proposal or submittal made pursuant to Paragraphs 6.05.A and 6.05.B. Engineer may require Contractor to furnish additional data about the proposed substitute item. The Owner and Engineer will be the exclusive judges of acceptability. No "or equal" or substitute will be ordered, installed, or utilized until Engineer's review is complete, which will be evidenced by a Change Order in the case of a substitute and an approved

Shop Drawing for an "or equal." Engineer will advise Contractor in writing of any negative determination.

D. *Special Guarantee:* Owner may require Contractor to furnish at Contractor's expense a special performance guarantee or other surety with respect to any substitute.

E. *Engineer's Cost Reimbursement:* Engineer will record Engineer's costs in evaluating a substitute proposed or submitted by Contractor pursuant to Paragraph 6.05.A.2 and 6.05.B. Whether or not Engineer approves a substitute so proposed or submitted by Contractor, Contractor shall reimburse Owner for the reasonable charges of Engineer for evaluating each such proposed substitute. Contractor shall also reimburse Owner for the reasonable charges of Engineer for making changes in the Contract Documents (or in the provisions of any other direct contract with Owner) resulting from the acceptance of each proposed substitute.

F. *Contractor's Expense:* It shall be Contractor's responsibility to coordinate all submittals to Engineer for approval to eliminate any conflicts that might arise due to the use of "or equal" items. Contractor shall provide all data in support of or incidental to the use of any proposed substitute or "or-equal" at Contractor's expense.

6.06 *Concerning Subcontractors, Suppliers, and Others*

A. Contractor shall not employ any Subcontractor, Supplier, or other individual or entity (including those acceptable to Owner as indicated in Paragraph 6.06.B), whether initially or as a replacement, against whom Owner may have reasonable objection. Owner's acceptance of any Subcontractor, Supplier, or other person or organization shall not constitute a waiver of any right of Owner to reject defective Work.

B. If the Supplementary Conditions require the identity of certain Subcontractors, Suppliers, or other individuals or entities to be submitted to Owner in advance for acceptance by Owner by a specified date prior to the Effective Date of the Agreement, and if Contractor has submitted a list thereof in accordance with the Supplementary Conditions, Owner's acceptance (either in writing or by failing to make written objection thereto by the date indicated for acceptance or objection in the Bidding Documents or the Contract Documents) of any such Subcontractor, Supplier, or other individual or entity so identified may be revoked on the basis of reasonable objection after due investigation. Contractor shall submit an acceptable replacement for the rejected Subcontractor, Supplier, or other individual or entity, and the Contract Price will be adjusted by the difference in the cost occasioned by such replacement, and an appropriate Change Order will be issued. No acceptance by Owner of any such Subcontractor, Supplier, or other individual or entity, whether initially or as a replacement, shall constitute a waiver of any right of Owner or Engineer to reject defective work.

C. Contractor shall be fully responsible to Owner and Engineer for all acts and omissions of the Subcontractors, Suppliers, and other individuals or entities performing or furnishing

any of the Work just as Contractor is responsible for Contractor's own acts and omissions. Nothing in the Contract Documents:

1. shall create for the benefit of any such Subcontractor, Supplier, or other individual or entity any contractual relationship between Owner and Engineer and any such Subcontractor, Supplier, or other individual or entity; nor

2. shall create any obligation on the part of Owner or Engineer to pay or to see to the payment of any moneys due any such Subcontractor, Supplier, or other individual or entity except as may otherwise be required by Laws and Regulations.

All subcontracts shall be in writing and shall specifically provide that the Owner is an intended third-party beneficiary of such subcontract.

D. Contractor shall be solely responsible for scheduling and coordinating the Work of Subcontractors, Suppliers, and other individuals or entities performing or furnishing any of the Work under a direct or indirect contract with Contractor.

E. Contractor shall require all Subcontractors, Suppliers, and such other individuals or entities performing or furnishing any of the Work to communicate with Engineer through Contractor.

F. Owner or Engineer may furnish to any Subcontractor, Supplier, or other person or entity, to the extent practicable, information about amounts paid to Contractor in accordance with Contractor's Applications for Payment on account of the particular Subcontractor's, Suppliers, or other person's or entity's work.

G. The divisions and sections of the Specifications and the identifications of any Drawings shall not control Contractor in dividing the Work among Subcontractors or Suppliers or delineating the Work to be performed by any specific trade.

H. All Work performed for Contractor by a Subcontractor or Supplier will be pursuant to an appropriate agreement between Contractor and the Subcontractor or Supplier which specifically binds the Subcontractor or Supplier to the applicable terms and conditions of the Contract Documents for the benefit of Owner and Engineer, specifically including the provisions of Paragraph 6.09.D. Contractor shall not award work valued at more than fifty percent (50%) of the Contract Price to subcontractor(s) without prior written approval of Owner.

I. Contractor shall make payments to Subcontractors in accordance with Massachusetts General Laws, Chapter 30, Section 39F, as amended, which provides as follows:

(a) 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 that 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.

(b) Not later than the sixty-fifth day after each subcontractor substantially completes his work in accordance with the Drawings 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.

(c) Each payment made by the Owner to the Contractor pursuant to subparagraphs (a) and (b) 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 (a) and (b), the Owner shall act upon the demand as provided in this section.

(d) If, within seventy 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 delivered to or sent by certified mail to the Contractor at the same time. The demand shall contain a detailed breakdown of the balance due under the subcontract and also a statement of the status of completion of the subcontract work. Any demand made after substantial completion of the subcontract work 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 the demand to the Owner and 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 against the subcontractor.

(e) Within fifteen days after receipt of the demand by the Owner, but in no event prior to the seventieth 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 (d). 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 parts (i) and (ii) of this subparagraph.

(f) The Owner shall forthwith deposit the amount deducted from a direct payment as provided in part (iii) of subparagraph (e) 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.

(g) 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 (f) shall be made out of amounts payable to the Contractor at the time of receipt of a demand for direct payment from a subcontractor and out of amounts which later become payable to the Contractor and in the 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.

(h) The Owner shall deduct from payments to a Contractor amounts which, together with the deposits in interest-bearing accounts pursuant to subparagraph (f), 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 in such deductions prior to any claims against such amounts by creditors of the Contractor.

J. Contractor agrees that it will fully comply with Subpart C of 2 CFR Part 180 and 2 CFR Part 1532, entitled Responsibilities of Participants Regarding Transactions (Doing Business with Other Persons). Contractor shall not award any subcontracts or purchase any materials from suppliers that appear on the Excluded parties List System. Contractor shall include this requirement in each subcontract and require it to be included in all subcontracts regardless of tier. Contractor shall maintain reasonable records to demonstrate compliance with these requirements.

6.07 *Patent Fees and Royalties*

A. Contractor shall pay all license fees and royalties and assume all costs incident to the use in the performance of the Work or the incorporation in the Work of any invention, design, process, product, or device which is the subject of patent rights or copyrights held by others. If a particular invention, design, process, product, or device is specified in the Contract Documents for use in the performance of the Work and if, to the actual knowledge of Owner or Engineer, its use is subject to patent rights or copyrights calling for the payment of any license fee or royalty to others, the existence of such rights shall be disclosed by Owner in the Contract Documents.

B. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any infringement of patent rights or copyrights incident to the use in the performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product, or device not specified in the Contract Documents.

6.08 *Permits*

A. Except as otherwise provided, Contractor shall obtain and pay for all construction permits and licenses identified in the Contract Documents or associated with the Project and give all notices necessary and due in connection with the lawful prosecution of the Work and shall furnish Owner with copies of such permits, licenses, notices, or other such authorizations. Contractor shall pay all governmental charges and inspection fees necessary for the prosecution of the Work which are applicable at the time of opening of Bids. Owner shall reimburse the Contractor for charges of utility owners for connections for providing permanent service to the Work.

6.09 *Laws and Regulations*

A. Contractor shall give all notices required by and shall comply with all Laws and Regulations applicable to the performance of the Work. Except where otherwise expressly required by applicable Laws and Regulations, neither Owner nor Engineer shall be responsible for monitoring Contractor's compliance with any Laws or Regulations.

B. If Contractor performs any Work knowing or having reason to know that it is contrary to Laws or Regulations, Contractor shall bear all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or other dispute resolution costs) arising out of or relating to such Work, including but not limited defending and indemnifying the City against any penalties imposed any government agency.

C. Changes in Laws or Regulations not known at the time of opening of Bids having an effect on the cost or time of performance of the Work shall be the subject of an

adjustment in Contract Price or Contract Times. If Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any such adjustment, a Claim may be made therefor as provided in Paragraph 10.05.

D. Contractor shall notify, and shall require subcontractors to notify, the Owner in writing of any violations of Laws and Regulations applicable to the performance of the Work or of any material violations of any contractual provisions governing the Work within 24 hours of becoming aware of such violations or by 5:00 p.m. on the business day following becoming aware of such violations, whichever is later. Contractor shall indemnify and defend the City against any claims arising out of the failure of the Contractor or any subcontractor to comply with this provision, including but not limited to any penalties imposed by any government agency.

6.10 *Taxes*

A. Contractor shall pay all sales, consumer, use, and other similar taxes required to be paid by Contractor in accordance with the Laws and Regulations of the place of the Project which are applicable during the performance of the Work.

B. Pursuant to Massachusetts General Laws, Chapter 64H, Section 6(f), the materials and supplies to be used in the Work under this Contract are exempt from the Sales and Use Tax of the Commonwealth of Massachusetts, and the Contract Price shall not include any amount therefor. Contractor shall obtain the proper certificates, maintain the necessary records, and otherwise comply with all applicable requirements governing the exemption from sales tax.

6.11 *Use of Site and Other Areas*

A. *Limitation on Use of Site and Other Areas:*

1. Contractor shall confine construction equipment, the storage of materials and equipment, and the operations of workers to the Site and other areas permitted by Paragraph 4.01 and Laws and Regulations, and shall not unreasonably encumber the Site and other areas with construction equipment or other materials or equipment. Contractor shall assume full responsibility for any damage to any such land or area, or to the owner or occupant thereof, or of any adjacent land or areas resulting from the performance of the Work.

2. Should any claim be made by any such owner or occupant because of the performance of the Work, Contractor shall promptly settle with such other party by negotiation or otherwise resolve the claim by arbitration or other dispute resolution proceeding or at law.

3. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members,

partners, employees, agents, consultants, and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or other dispute resolution costs) arising out of or relating to any claim or action, legal or equitable, brought by any such owner or occupant against Owner, Engineer, or any other party indemnified hereunder to the extent caused by or based upon Contractor's performance of the Work.

B. *Removal of Debris During Performance of the Work:*

i. During the progress of the Work Contractor shall keep the Site and other areas free from accumulations of waste materials, rubbish, and other debris. Removal and disposal of such waste materials, rubbish, and other debris shall conform to applicable Laws and Regulations.

ii. Contractor shall arrange to dispose of all liquid and solid refuse in a lawful, safe, efficient, and anti-pollutant manner subject to the prior approval of the City.

iii. Contractor shall remove daily from the Site by means provided by the Contractor all garbage, debris, and other waste materials (whether solid or liquid) arising out of or in connection with its operations hereunder, and any such garbage, debris, and other waste materials not immediately removed shall be temporarily stored in a clean and sanitary condition, approved by the Owner, in suitable garbage and waste receptacles, also approved by the Owner and shall be kept covered except when filling and emptying them. Contractor shall exercise care in removing such garbage, debris, and other waste materials from the Site. The manner of such storage and removal shall always be subject in all respects to the continued approval of the Owner. No equipment or facilities of the Owner shall be used in such removal unless prior written consent is given by the Owner. No such garbage, debris, or other waste materials shall be or be permitted to be thrown, discharged, or disposed into or upon waters or bounding the Site.

C. *Cleaning:* Prior to Substantial Completion of the Work Contractor shall clean the Site and the Work and make it ready for utilization by Owner. At the completion of the Work Contractor shall remove from the Site all tools, appliances, construction equipment and machinery, and surplus materials and shall restore to original condition all property not designated for alternation by the Contract Documents.

D. *Loading Structures:* Contractor shall not load or permit any part of any structure to be loaded in any manner that will endanger the structure, nor shall Contractor subject any part of the Work or adjacent property to stresses or pressures that will endanger it.

6.12 *Use of Record Documents*: Contractor shall maintain in a safe place at the Site one record copy of all Drawings, Specifications, Addenda, Change Orders, Work Change Directives, Field Orders, Contract Documents and written interpretations and clarifications in good order and annotated to show changes made during construction. These record documents together with

all approved Samples and a counterpart of all approved Shop Drawings will be available to Engineer for reference. Upon completion of the Work, these record documents, Samples, and Shop Drawings will be delivered to Engineer for Owner.

6.13 *Safety and Protection*

A. Contractor shall be solely responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the Work. Such responsibility does not relieve Subcontractors of their responsibility for the safety of persons or property in the performance of their work, nor for compliance with applicable safety Laws and Regulations. Contractor shall take all necessary precautions for the safety of, and shall provide the necessary protection to prevent damage, injury, or loss to:

1. all persons on the Site or who may be affected by the Work;

2. all the Work and materials and equipment to be incorporated therein, whether in storage on or off the Site; and

3. other property at the Site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures, utilities, and Underground Facilities not designated for removal, relocation, or replacement in the course of construction.

B. Contractor shall comply with all applicable Laws and Regulations relating to the safety of persons or property, or to the protection of persons or property from damage, injury, or loss; and shall erect and maintain all necessary safeguards for such safety and protection. Safety provisions for confined space entry shall conform to General Industry Standard CFR Title 29 Part 1910.146. Contractor shall notify owners of adjacent property and of Underground Facilities and other utility owners when prosecution of the Work may affect them, and shall cooperate with them in the protection, removal, relocation, and replacement of their property.

C. All damage, injury, or loss to any property referred to in Paragraph 6.13.A.2 or 6.13.A.3 caused, directly or indirectly, in whole or in part, by Contractor, any Subcontractor, Supplier, or any other individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, shall be remedied by Contractor.

D. Contractor's duties and responsibilities for safety and for protection of the Work shall continue until such time as all of the Work is completed and Engineer has issued a notice to Owner and Contractor in accordance with Paragraph 14.06 that the Work is acceptable (except as otherwise expressly provided in connection with Substantial Completion).

E. When Work is performed at roadway locations, all operations shall be planned so as to cause minimum interference with traffic, and with maximum precautions at all times.

F. Contractor shall have due regard to the location of detours and to the provisions for

handling traffic, and shall not open up Work to the prejudice or detriment of Work already started. When it is required under the Contract that traffic be detoured around the Work, the Contractor shall provide and maintain suitable detours in accordance with the Contract Documents, and as approved by Owner.

G. Contractor shall be responsible for the maintenance of traffic over, through or around the Work during the life of the Contract, and whether or not work thereon has been suspended temporarily. The Contractor shall take all precautions for preventing injuries to persons or damage to property in or about the Work. The Contractor shall provide and maintain temporary bypasses as may be necessary to accommodate traffic on the roadway under construction or repair.

H. All Work sites and adjacent areas shall be adequately protected. Roadways shall be closed to traffic only as approved by the City. Whenever the closing of any lane is permitted by Owner, the Contractor shall comply with all pertinent provisions of the Contract Documents.

I. All personnel shall observe safety rules and regulations and shall wear suitable safety equipment, at all times. Personnel who disregard safety regulations will be barred from the Work by the Owner, and the Contractor shall be without recourse.

J. All vehicles and construction equipment shall be properly registered and comply with the Laws and Regulations. All vehicles shall be equipped with such safety devices as flags, markings, beacons, strobes, and lights, in good working order. No separate compensation will be allowed for this work or equipment.

K. At the end of each work day, the Contractor shall remove its equipment from the roadway, and if applicable, shall store such equipment in areas as approved by Owner. No equipment shall be stored on the roadway during non-work periods. Construction or repair materials shall not be stored on the roadway except as approved by Owner.

6.14 *Safety Representative*: Contractor shall designate a qualified and experienced safety representative at the Site whose duties and responsibilities shall be the prevention of accidents and the maintaining and supervising of safety precautions and programs.

6.15 *Hazard Communication Programs*: Contractor shall be responsible for coordinating any exchange of material safety data sheets or other hazard communication information required to be made available to or exchanged between or among employees at the Site in accordance with Laws or Regulations.

6.16 *Emergencies*: In emergencies affecting the safety or protection of persons or the Work or property at the Site or adjacent thereto, Contractor is obligated to act to prevent threatened damage, injury, or loss. Contractor shall give Engineer written notice immediately, and in no instance more than 24 hours after the alleged emergency, if Contractor believes that any significant changes in the Work or variations from the Contract Documents have been caused thereby or are required as a result thereof. If Engineer determines that a change in the Contract

Documents is required because of the action taken by Contractor in response to such an emergency, a Work Change Directive or Change Order will be issued. Should the Contractor fail to take prompt action whenever conditions make it necessary in the Owner's sole discretion, Owner may make emergency repairs or cause the same to be made, and the costs for such repairs shall be charged against the Contractor and deducted from moneys due to it.

6.17 *Shop Drawings and Samples*

A. Contractor shall submit Shop Drawings and Samples to Engineer for review and approval in accordance with the accepted Schedule of Submittals (as required by Paragraph 2.03). Each submittal will be identified as Engineer may require.

1. *Shop Drawings:*

a. Submit number of copies specified in the Specifications.

b. Data shown on the Shop Drawings will be complete with respect to quantities, dimensions, specified performance and design criteria, materials, and similar data to show Engineer the services, materials, and equipment Contractor proposes to provide and to enable Engineer to review the information for the limited purposes required by Paragraph 6.17.E.

2. *Samples:*

a. Submit number of Samples specified in the Specifications.

b. Clearly identify each Sample as to material, Supplier, pertinent data such as catalog numbers, the use for which intended and other data as Engineer may require to enable Engineer to review the submittal for the limited purposes required by Paragraph 6.17.E.

B. Where a Shop Drawing or Sample is required by the Contract Documents or the Schedule of Submittals, any related Work performed prior to Engineer's review and approval of the pertinent submittal will be at the sole expense and responsibility of Contractor.

C. Contractor is responsible for the accuracy of all Submittals. Owner and Engineer shall be entitled to rely upon Contractor's representation that such information is correct and accurate.

D. *Submittal Procedures:*

1. Before submitting each Shop Drawing or Sample, Contractor shall have:

a. reviewed and coordinated each Shop Drawing or Sample with other Shop Drawings and Samples and with the requirements of the Work and the Contract Documents;

b. determined and verified all field measurements, quantities, dimensions, specified performance and design criteria, installation requirements, materials, catalog numbers, and similar information with respect thereto;

c. determined and verified the suitability of all materials offered with respect to the indicated application, fabrication, shipping, handling, storage, assembly, and installation pertaining to the performance of the Work; and

d. determined and verified all information relative to Contractor's responsibilities for means, methods, techniques, sequences, and procedures of construction, and safety precautions and programs incident thereto.

2. Each submittal shall bear a stamp or specific written certification that Contractor has satisfied Contractor's obligations under the Contract Documents with respect to Contractor's review and approval of that submittal.

3. With each submittal, Contractor shall give Engineer specific written notice of any variations that the Shop Drawing or Sample may have from the requirements of the Contract Documents. This notice shall be both a written communication separate from the Shop Drawings or Sample submittal; and, in addition, by a specific notation made on each Shop Drawing or Sample submitted to Engineer for review and approval of each such variation.

E. *Engineer's Review:*

1. Engineer will provide timely review of Shop Drawings and Samples in accordance with the Schedule of Submittals acceptable to Engineer. Engineer's review and approval will be only to determine if the items covered by the submittals will, after installation or incorporation in the Work, conform to the information given in the Contract Documents and be compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents.

2. Engineer's review and approval will not extend to means, methods, techniques, sequences, or procedures of construction (except where a particular means, method, technique, sequence, or procedure of construction is specifically and expressly called for by the Contract Documents) or to safety precautions or programs incident thereto. The review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.

3. Engineer's review and approval shall not relieve Contractor from responsibility for any variation from the requirements of the Contract Documents. Engineer's review and approval shall not relieve Contractor from responsibility for complying with the requirements of Paragraph 6.17.D.

F. *Resubmittal Procedures:* Contractor shall make corrections required by Engineer and shall return the required number of corrected copies of Shop Drawings and submit, as required, new Samples for review and approval. Contractor shall direct specific attention in writing to revisions other than the corrections called for by Engineer on previous submittals. The

Contractor, rather than the Owner, shall pay for any fees and/or charges assessed by the Engineer in connection with its review of any second and subsequent resubmittal of a Shop Drawing or Sample.

6.18 *Contractor's General Warranty and Guarantee*

A. Contractor guarantees that the Work to be performed under this Agreement, and all workmanship, materials, and equipment performed, furnished, used, or installed in the construction of the same shall be free from defects and flaws and shall be performed and furnished in strict accordance with the Contract Documents, that the strength of all parts of all manufactured equipment shall be adequate and as specified and that the performance test requirements of the Agreement shall be fulfilled.

B. Contractor's obligation to perform and complete the Work in accordance with the Contract Documents shall be absolute. None of the following will constitute an acceptance of Work that is not in accordance with the Contract Documents or a release of Contractor's obligation to perform the Work in accordance with the Contract Documents:

1. observations by Engineer;

2. recommendation by Engineer or payment by Owner of any progress or final payment;

3. the issuance of a certificate of Substantial Completion by Engineer or any payment related thereto by Owner;

4. use or occupancy of the Work or any part thereof by Owner;

5. any review and approval of a Shop Drawing or Sample submittal or the issuance of a notice of acceptability by Engineer;

6. any inspection, test, or approval by others; or

7. any correction of defective Work by Owner.

C. Contractor shall guarantee all materials and equipment furnished and Work performed for a period of one (1) year from the date of Final Completion, unless a longer period is set forth in the Contract Documents. If part of the Work is accepted in accordance with Paragraph 14.05 of the General Conditions, the guarantee for that portion of the Work shall be for a period of two (2) years from the date fixed for such acceptance. Contractor warrants and guarantees for a period of one (1) year from the date of Final Completion, or such longer period set forth in the Contract Documents, that the completed Work is free from all defects due to faulty materials or workmanship. If at any time within the said period of guarantee any part of the Work requires repairing, correction, or replacement, Owner may notify Contractor to commence making such repairs, correction, or replacements and Contractor shall promptly make such repairs, corrections, or replacements as may be necessary by reason of such defects including the repair of any damage to other property or systems resulting from such defects. In the event that Contractor should fail to make such repairs, adjustments, or other work that may be made necessary by such defects to the satisfaction

of Owner within seven (7) days from receipt of such notice, Owner may do so and charge Contractor the cost thereby incurred, including compensation for additional professional services. The Performance Bond shall remain in full force and effect through the guarantee period.

6.19 *Delegation of Professional Design Services*

A. Contractor will not be required to provide professional design services unless such services are specifically required by the Contract Documents for a portion of the Work or unless such services are required to carry out Contractor's responsibilities for construction means, methods, techniques, sequences and procedures. Contractor shall not be required to provide professional services in violation of applicable law.

B. If professional design services or certifications by a design professional related to systems, materials or equipment are specifically required of Contractor by the Contract Documents, Owner and Engineer will specify all performance and design criteria that such services must satisfy. Contractor shall cause such services or certifications to be provided by a properly licensed professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, Shop Drawings and other submittals prepared by such professional. Shop Drawings and other submittals related to the Work designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to Engineer.

C. Owner and Engineer shall be entitled to rely upon the adequacy, accuracy and completeness of the services, certifications or approvals performed by such design professionals.

D. Pursuant to this Paragraph 6.19, Engineer's review and approval of design calculations and design drawings will be only for the limited purpose of checking for conformance with performance and design criteria given and the design concept expressed in the Contract Documents. Engineer's review and approval of Shop Drawings and other submittals (except design calculations and design drawings) will be only for the purpose stated in Paragraph 6.17.E.

6.20 *Records*: Contractor shall comply with all applicable provisions of Massachusetts General Laws, Chapter 30, Section 39R regarding Contractor's records.

ARTICLE 7 – OTHER WORK AT THE SITE

7.01 *Related Work at Site*

A. Owner may perform other work related to the Project at the Site with Owner's employees, or through other direct contracts therefor, or have other work performed by utility owners. If such other work is not noted in the Contract Documents, then written notice thereof will be given to Contractor prior to starting any such other work.

B. Contractor shall afford each other contractor who is a party to such a direct contract, each utility owner, and Owner, if Owner is performing other work with Owner's employees, proper and safe access to the Site, provide a reasonable opportunity for the introduction and storage of materials and equipment and the execution of such other work, and properly coordinate the Work with theirs. Contractor shall do all cutting, fitting, and patching of the Work that may be required to properly connect or otherwise make its several parts come together and properly integrate with such other work. Contractor shall not endanger any work of others by cutting, excavating, or otherwise altering such work; provided, however, that Contractor may cut or alter others' work with the written consent of Engineer and the others whose work will be affected.

C. If the proper execution or results of any part of Contractor's Work depends upon work performed by others under this Article 7, Contractor shall inspect such other work and promptly report to Engineer in writing any delays, defects, or deficiencies in such other work that render it unavailable or unsuitable for the proper execution and results of Contractor's Work. Contractor's failure to so report will constitute an acceptance of such other work as fit and proper for integration with Contractor's Work.

7.02 *Coordination*

A. If Owner intends to contract with others for the performance of other work on the Project at the Site, the following will be set forth in Supplementary Conditions:

1. the individual or entity who will have authority and responsibility for coordination of the activities among the various contractors will be identified;

2. the specific matters to be covered by such authority and responsibility will be itemized; and

3. the extent of such authority and responsibilities will be provided.

B. Owner shall have sole authority and responsibility for such coordination.

7.03 *Legal Relationships*

A. Paragraphs 7.01 and 7.02 are not applicable for utilities not under the control of Owner.

B. Contractor shall be liable to Owner and any other contractor under direct contract to Owner for the reasonable direct delay and disruption costs incurred by such other contractor as a result of Contractor's wrongful action or inactions. Should Contractor cause damage to the work or property of any other contractor under direct contract to Owner, or should any claim arising out of Contractor's performance of the Work be made by any such other contractor against Contractor, Owner, Engineer, Owner's or Engineer's agents, employees, or consultants, or any other person or entity, Contractor shall promptly attempt to settle by agreement, or otherwise to resolve the dispute.

C. Should any other contractor under direct contract to Owner cause damage to the Work or property of Contractor, or should the performance of work by any such other contractor

give rise to any other claim, Contractor shall not institute any action, legal or equitable, against Owner, Engineer, or Owner's or Engineer's agents, employees, or consultants, or permit any action against any of them to be maintained or continued in its name or for its benefit on such damage or claim. Contractor hereby agrees it shall have no claim for damages of any kind against Owner, Engineer, or Owner's or Engineer's agents, employees, or consultants on account of any delay in the performance or furnishing of the Work and/or any delay or suspension of any portion of the Work, arising out of such other contractor's work. Contractor's sole remedy for any such delay and/or suspension will be an extension of time in accordance with Paragraph 12.02.

ARTICLE 8 – OWNER'S RESPONSIBILITIES

8.01 *Communication Contractor:* Except as otherwise provided in these General Conditions, owner shall issue all communications to the Contractor through Engineer.

8.02 *Replacement of Engineer:* In case of termination of the employment of Engineer, Owner shall appoint an engineer whose status under the Contract Documents shall be that of the former Engineer.

8.03 *Limitations on Owner's Responsibilities*

A. The Owner shall not supervise, direct, or have control or authority over, nor be responsible for, Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work. Owner will not be responsible for Contractor's failure to perform the Work in accordance with the Contract Documents.

B. In carrying out the provisions of the Contract or in exercising any power or authority granted them by their position, there shall be no liability upon the members of the Owner, its agents, or employees, or their authorized representatives or assistants, either personally or as officials of the Owner, it being understood that in such matters they act as agents and representatives of the Owner.

ARTICLE 9 – ENGINEER'S STATUS DURING CONSTRUCTION

9.01 *Owner's Representative:* Engineer will be Owner's representative during the construction period. The duties and responsibilities and the limitations of authority of Engineer as Owner's representative during construction are set forth in the Contract Documents.

9.02 *Visits to Site:* Engineer will make visits to the Site at intervals appropriate to the various stages of construction in order to observe as an experienced and qualified design professional the progress that has been made and the quality of the various aspects of Contractor's executed Work. Based on information obtained during such visits and observations, Engineer, for the

benefit of Owner, will determine if the Work is proceeding in accordance with the Contract Documents.

9.03 *Project Representative:* Engineer will furnish a Resident Project Representative to assist Engineer in providing more extensive observation of the Work. The authority and responsibilities of any such Resident Project Representative and assistants will be as provided in the Supplementary Conditions, and limitations on the responsibilities thereof will be as provided in Paragraph 9.08. If Owner designates another representative or agent to represent Owner at the Site who is not Engineer's consultant, agent or employee, the responsibilities and authority and limitations thereon of such other individual or entity will be as provided in the Supplementary Conditions.

9.04 *Authorized Variations in Work:* Engineer may authorize minor variations in the Work from the requirements of the Contract Documents which do not involve an adjustment in the Contract Price or the Contract Times and are compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. These may be accomplished by a Field Order and will be binding on Owner and also on Contractor, who shall sign the Field Order and perform the Work involved promptly. Contractor's signature confirms that the Contractor is not entitled to any change in the Contract Price or the Contract Times in connection therewith.

9.05 *Rejecting Defective Work:* Engineer will have authority to reject Work that Engineer believes to be defective, or that Engineer believes will not produce a completed Project that conforms to the Contract Documents, or that will prejudice the integrity of the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. Engineer will also have authority to require special inspection or testing of the Work as provided in Paragraph 13.03, at the Contractor's expense, whether or not the Work is fabricated, installed, or completed.

9.06 *Determinations for Unit Price Work*

A. The Owner and Engineer will determine the actual quantities and classifications of Unit Price Work performed by Contractor. Engineer will review with Contractor the Engineer's preliminary determinations on such matters before rendering a written decision thereon (by recommendation of an Application for Payment or otherwise). The Owner's or Engineer's written decision thereon will be final and binding (except as modified to reflect changed factual conditions or more accurate data) upon the Contractor, subject to the provisions of Paragraph 10.05.

B. Contractor shall notify the Owner and Engineer in writing as soon as the Contractor suspects, or reasonably should suspect, that the actual quantity of any item used or consumed in connection with the Work may exceed by 15% or greater the estimated quantity identified in the Price Sheet for such item.

9.07 *Decisions on Requirements of Contract Documents and on Acceptability of Work*

A. Engineer will be the initial interpreter of the requirements of the Contract Documents and judge of the acceptability of the Work thereunder. All matters in question and other matters between Owner and Contractor arising prior to the date final payment is due relating to the acceptability of the Work, and the interpretation of the requirements of the Contract Documents pertaining to the performance of the Work, will be referred initially to Engineer in accordance with the provisions of Paragraph 10.05, with a request for a formal decision. Contractor's submission of such matter (except any which have been waived in accordance with the provisions of the Contract Documents) to Engineer in writing shall be a condition precedent to any exercise of such rights or remedies as it may otherwise have under the Contract Documents or by Laws or Regulations in respect of any such matter.

B. Engineer will, with reasonable promptness, render a written decision on the issue referred. If Owner or Contractor believes that any such decision entitles them to an adjustment in the Contract Price or Contract Times or both, a Claim may be made under Paragraph 10.05. The date of Engineer's decision shall be the date of the event giving rise to the issues referenced for the purposes of Paragraph 10.05.B.

C. Owner's decision upon receipt of Engineer's recommendation will be final and binding on Contractor.

D. Decisions on requirements on the Contract Documents and on acceptability of the Work will be made in accordance with Massachusetts General Laws, Chapter 30, Section 39P.

9.08 *Limitations on Engineer's Authority and Responsibilities*

A. Neither Engineer's authority or responsibility under this Article 9 or under any other provision of the Contract Documents nor any decision made by Engineer in good faith either to exercise or not exercise such authority or responsibility or the undertaking, exercise, or performance of any authority or responsibility by Engineer shall create, impose, or give rise to any duty in contract, tort, or otherwise owed by Engineer to Contractor, any Subcontractor, any Supplier, any other individual or entity, or to any surety for or employee or agent of any of them.

B. Engineer will not supervise, direct, control, or have authority over or be responsible for Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work. Engineer will not be responsible to Contractor for Contractor's failure to perform the Work in accordance with the Contract Documents.

C. Engineer will not be responsible for the acts or omissions of Contractor or of any Subcontractor, any Supplier, or of any other individual or entity performing any of the Work on behalf of Contractor.

D. Engineer's review of the final Application for Payment and accompanying documentation and all maintenance and operating instructions, schedules, guarantees, bonds, certificates of inspection, tests and approvals, and other documentation required to be delivered by

Paragraph 14.07.A will be to determine that their content complies with the requirements of, and in the case of certificates of inspections, tests, and approvals that the results certified indicate compliance with, the Contract Documents.

E. The limitations upon authority and responsibility set forth in this Paragraph 9.09 shall also apply to the Resident Project Representative, if any, and assistants, if any.

9.09 *Compliance with Safety Program:* While at the Site, Engineer's employees and representatives shall comply with the specific applicable requirements of Contractor's safety programs of which Engineer has been informed pursuant to Paragraph 6.13.

ARTICLE 10 – CHANGES IN THE WORK; CLAIMS

10.01 *Authorized Changes in the Work*

A. Without invalidating the Contract and without notice to any surety, Owner may, at any time or from time to time, order additions, deletions, or revisions in the Work by a Change Order, or a Work Change Directive. Upon receipt of any such document, Contractor shall promptly proceed with the Work involved which will be performed under the applicable conditions of the Contract Documents (except as otherwise specifically provided). A change in the Contract Price or the Contract Times shall be accomplished only by a written Change Order. Accordingly, no course of conduct or dealings between the parties, no expressed or implied acceptance of alterations or additions to the Work, and no claim that the owner has been unjustly enriched by any alterations or additions to the Work shall be the basis of any Claim for an increase in any amount due under the Contract Documents or a change in any time period provided for in the Contract Documents. Under no circumstances will an act or failure to act on the part of the Owner or Engineer constitute a waiver of the written Change Order requirement for extra work. A written Change Order is a strict condition precedent for payment for extra work.

B. Upon request of Owner or Engineer, Contractor shall without cost to Owner submit to Engineer, in such form as Engineer may require, an accurate written estimate of the cost of any such proposed extra Work or change. The estimate shall indicate the quantity and unit cost of each item of materials, and the number of hours of work and hourly rate for each class of labor, as well as the description and amounts of all other costs chargeable under the terms of this Article. Unit labor costs for the installation of each item of material shall be shown if required by Engineer. Contractor shall promptly revise and resubmit such estimate if Engineer determines that it is not in compliance with the requirements of this Article, or that it contains errors of fact or mathematical errors. If required by Engineer, Contractor shall obtain and furnish to Engineer bona fide proposals from recognized suppliers for furnishing any material included in such work. Such estimates shall be furnished promptly so as to occasion no delay in the Work, and shall be furnished at Contractor's expense. Contractor shall state in the estimate any extension of time required for completion of the Work if the change or extra work is ordered.

C. If Owner and Contractor are unable to agree on entitlement to, or on the amount or extent, if any, of an adjustment in the Contract Price or Contract Times, or both, that should be allowed as a result of a Work Change Directive, a Claim may be made therefor as provided in Paragraph 10.05.

10.02 *Unauthorized Changes in the Work:* Contractor shall not be entitled to an increase in the Contract Price or an extension of the Contract Times with respect to any work performed that is not required by the Contract Documents as amended, modified, or supplemented as provided in Paragraph 3.04, except in the case of an emergency as provided in Paragraph 6.16 or in the case of uncovering Work as provided in Paragraph 13.04.D.

10.03 *Execution of Change Orders*

A. Owner and Contractor shall execute appropriate Change Orders recommended by Engineer covering:

1. changes in the Work which are: (i) ordered by Owner pursuant to Paragraph 10.01.A, (ii) required because of acceptance of defective Work under Paragraph 13.08.A or Owner's correction of defective Work under Paragraph 13.09, or (iii) agreed to by the parties;

2. changes in the Contract Price or Contract Times which are agreed to by the parties, including any undisputed sum or amount of time for Work actually performed in accordance with a Work Change Directive; and

3. changes in the Contract Price or Contract Times which embody the substance of any written decision rendered by Engineer pursuant to Paragraph 10.05; provided that, in lieu of executing any such Change Order, an appeal may be taken from any such decision in accordance with the provisions of the Contract Documents and applicable Laws and Regulations, but during any such appeal, Contractor shall carry on the Work and adhere to the Progress Schedule.

Agreements on any Change Order shall constitute a final settlement of all matters relating to the change in the Work that is the subject of the change order, including, but not limited to, all direct and indirect costs associated with such change and any and all adjustments to the Contract Price and the Contract Times. In the event a Change Order increases the Contract Price, the Contractor shall include the Work covered by such a Change Order in applications for payments as if such Work were originally part of the Contract Documents.

10.04 *Notification of Surety:* If the provisions of any bond require notice to be given to a surety of any change affecting the general scope of the Work or the provisions of the Contract Documents (including, but not limited to, Contract Price or Contract Times), the giving of any such notice will be Contractor's responsibility. The amount of each applicable bond will be adjusted to reflect the effect of any such change.

10.05 *Claims*

A. *Engineer's Review*: All Claims, except those waived pursuant to Paragraph 14.09, shall be referred to the Engineer for review.

B. *Notice:* Written notice stating the general nature of each Claim shall be delivered by the claimant to Engineer and the other party to the Contract promptly (but in no event later than 30 days) after the start of the event giving rise thereto. The responsibility to substantiate a Claim shall rest with the party making the Claim. Notice of the amount or extent of the Claim, with supporting data shall be delivered to the Engineer and the other party to the Contract within 60 days after the start of such event (unless Engineer allows additional time for claimant to submit additional or more accurate data in support of such Claim). A Claim for an adjustment in Contract Price shall be prepared in accordance with the provisions of Paragraph 12.01. A Claim for an adjustment in Contract Times shall be prepared in accordance with the provisions of Paragraph 12.02. Each Claim shall be accompanied by claimant's written statement that the adjustment claimed is the entire adjustment to which the claimant believes it is entitled as a result of said event. The opposing party shall submit any response to Engineer and the claimant within 30 days after receipt of the claimant's last submittal (unless Engineer allows additional time).

C. *Engineer's Action*: Engineer will review each Claim and, within 30 days after receipt of the last submittal of the claimant or the last submittal of the opposing party, if any, recommend in writing that the Owner take one of the following actions:

1. deny the Claim in whole or in part;

2. approve the Claim; or

3. notify the parties that the Engineer is unable to resolve the Claim if it would be inappropriate for the Engineer to do so. For purposes of further resolution of the Claim, such notice shall be deemed a recommendation to deny.

D. In the event that Engineer does not take action on a Claim within said 30 days, the parties shall proceed as if the Engineer recommended denial of such Claim.

E. Engineer's recommendation under Paragraph 10.05.C or denial pursuant to Paragraphs 10.05.C.3 or 10.05.D will be final and binding upon Contractor, unless (1) Owner issues a separate written decision on the Claim within 30 days of receipt of the Engineer's recommendation, in which case Owner's written decision shall be final and binding on Contractor; or (2) Contractor invokes the dispute resolution procedure set forth in Article 16 within 30 days of such recommendation or denial.

F. No Claim for an adjustment in Contract Price or Contract Times will be valid if not submitted in accordance with this Paragraph 10.05.

ARTICLE 11 – COST OF THE WORK; UNIT PRICE WORK

11.01 *Costs of the Work*

A. *Costs Included:* The term Cost of the Work means the sum of all costs, except those excluded in Paragraph 11.01.C, necessarily incurred and paid by Contractor in the proper performance of the Work. When the value of any Work covered by a Change Order or when a Claim for an adjustment in Contract Price is determined on the basis of Cost of the Work, the costs to be reimbursed to Contractor will be only those additional or incremental costs required because of the change in the Work or because of the event giving rise to the Claim. Except as otherwise may be agreed to in writing by Owner, such costs shall be in amounts no higher than those prevailing in the locality of the Project, shall not include any of the costs itemized in Paragraph 11.01.C, and shall include only the items identified in Paragraph 11.01.B.

B. As used in this Paragraph 11.01, the following terms shall be defined as:

1. *Labor* - Only those workers employed on the Project who are doing the extra work, including the foreman in charge, are allowable. General foremen, superintendents, or other supervisory personnel are considered to be included in the overhead markup as provided in item 5. Hourly labor rates in excess of those as listed in the contract wage rates (Federal or State, whichever applies) require documentation. At a minimum, an explanation and the appropriate copy of the certified payroll are required.

2. *Direct Labor Costs* - These costs are limited to those listed as follows. Coverage in excess of the Contract provisions, secured by the Contractor/subcontractor(s) at his option, are ineligible for financial assistance.

    a. Workman's Compensation

    b. Federal/State: Social Security Tax and Unemployment Tax;

    c. Health, Welfare and Pension Benefits; (this cost is included in the wage rates appearing in the Mass. Wage Rates of the contract specifications)

    d. Liability Insurance: Any liability insurance required by contract,

    e. If applied to any required Direct Labor Costs, Blasters Insurance, Builders Risk Insurance, Experience Modification Insurance, and surcharges.

    Following award and prior to execution of a construction contract, the contractor shall submit for review by the owner, documentation to establish the Direct Labor Cost percentage(s) (Direct Labor markup percentage(s)). The documented direct labor markup for this contract may be adjusted on an annual basis as measured from the date the contract is executed.

3. *Material and Freight* – Only those materials required as a result of the Change Order and reasonable freight charges for delivery of same are allowable.

4. *Equipment* - Only the equipment required as a result of the Change Order is allowable. Equipment rental rates shall be governed by the current Nielson/Dataquest Rental Rate bluebook for Construction Equipment (the "Bluebook"). In determining the rental rate the following shall apply:

    a. For equipment already on the project – the monthly prorated rental rate by the hourly use shall be applicable;

    b. For equipment not on the project the daily rate, the weekly rate, or monthly rate will prevail, whichever will prove to be most cost effective. Small tools and manual equipment are examples of costs not allowable under this item. These costs are considered to be included in the overhead markup as provided in item 5
    (1 month (normal use) = 176 hours)

5. *Overhead and Profit* – All other costs not previously mentioned are considered to be included in this item, be it for the General Contractor or subcontractor(s).

6. *Credits* – Work deleted, material and equipment removed from the Site, stored and/or returned, shall be credited to the cost of the Change Order, less costs.

C. The value of any Work covered by a Change Order or of any Claim for an adjustment in the Contract Price will be determined as follows:

    1. Where the Work involved is covered by unit prices contained in the Contract Documents, by application of such unit prices to the quantities of the items involved (subject to the provisions of Paragraph 11.02); or

    2. Where the Work involved is not covered by unit prices contained in the Contract Documents, by a mutually agreed lump sum or unit price basis, as specified by the Engineer. The stated price, either lump sum or unit price, shall be divided so as to show that it is the sum of:

        a. The estimated cost of labor, plus

        b. Direct Labor Cost, plus

        c. Material and Freight Costs, plus

        d. Equipment Costs, plus

        e. An amount not to exceed 15% of the sum of items (a) through (d) for overhead and profit, plus (if applicable)

        f. In the case of work done by a subcontractor an amount not to exceed 7 ½ %, for the General Contractor of the sum of items (a) through (d) for his overhead and profit, less, if applicable,

        g. Credits for work deleted from the Contract.

3. Unless an agreed lump sum and/or unit price is obtained under Paragraph 12.01.B.2, Contractor shall accept as full payment for which no other agreement is contained in the Contract, an amount equal to:

    a. The estimated cost of Labor, plus

    b. Direct Labor Cost, plus

    c. Material and Freight Costs, plus

    d. Equipment Costs, plus

    e. An amount not to exceed 15% of the sum of items (a) through (d) for overhead and profit, plus (if applicable)

    f. In the case of work done by a subcontractor an amount not to exceed 7 ½ %, for the general contractor of the sum of items (a) through (d) for his overhead and profit, less, if applicable,

    g. Credits for work deleted from the contract.

D. *Costs Excluded:* The term Cost of the Work shall not include any of the following items:

1. Payroll costs and other compensation of Contractor's officers, executives, principals (of partnerships and sole proprietorships), general managers, safety managers, engineers, architects, estimators, attorneys, auditors, accountants, purchasing and contracting agents, expediters, timekeepers, clerks, and other personnel employed by Contractor, whether at the Site or in Contractor's principal or branch office for general administration of the Work and not specifically included in the agreed upon schedule of job classifications referred to in Paragraph 11.01.B.1, all of which are to be considered administrative costs covered by the Contractor's fee.

2. Expenses of Contractor's principal and branch offices other than Contractor's office at the Site.

3. Any part of Contractor's capital expenses, including interest on Contractor's capital employed for the Work and charges against Contractor for delinquent payments.

4. Costs due to the negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, including but not limited to, the correction of defective Work, disposal of materials or equipment wrongly supplied, and making good any damage to property.

5. Costs of transportation and storage of materials and equipment during periods when such materials and equipment are unused or unnecessary for purposes of performing the Work.

6. Other overhead or general expense costs of any kind and the costs of any item not specifically and expressly included in Paragraph 11.01.B.

E. *Documentation:* Whenever the Cost of the Work for any purpose is to be determined pursuant to Paragraphs 11.01.A and 11.01.B, Contractor will establish and maintain records thereof in accordance with generally accepted accounting practices and submit in a form acceptable to Engineer an itemized cost breakdown together with supporting data. Contractor shall furnish itemized statements of the cost of the Work ordered and shall give Engineer access to all accounts, bills, and vouchers relating thereto; unless Contractor shall furnish such itemized statements, and access to all accounts, bills, and vouchers, he shall not be entitled to payment for any items for which such information is sought by the Engineer.

F. If required by Owner, Contractor shall obtain competitive bids from subcontractors acceptable to Owner and Contractor shall deliver such bids to Owner, who will then determine, with the recommendation of Engineer, which bids, if any, will be acceptable. If any subcontract provides that the Subcontractor is to be paid on the basis of Cost of the Work plus a fee, the Subcontractor's Cost of the Work and fee shall be determined in the same manner as Contractor's Cost of the Work and fee as provided in this Paragraph 11.01.

11.02 *Unit Price Work*

A. Where the Contract Documents provide that all or part of the Work is to be Unit Price Work, initially the Contract Price will be deemed to include for all Unit Price Work an amount equal to the sum of the unit price for each separately identified item of Unit Price Work times the estimated quantity of each item as indicated in the Agreement.

B. The estimated quantities of items of Unit Price Work are not guaranteed and are solely for the purpose of comparison of Bids and determining an initial Contract Price. Determinations of the actual quantities and classifications of Unit Price Work performed by Contractor will be made subject to the provisions of Paragraph 9.08.

C. Each unit price will be deemed to include an amount considered by Contractor to be adequate to cover Contractor's overhead and profit for each separately identified item.

D. The Unit Price of an item of Unit Price Work shall be subject to reevaluation and adjustment under the following conditions:

1. if the Bid price of a particular item of Unit Price Work amounts to 5 percent or more of the Contract Price and the variation in the quantity of that particular item of Unit Price Work performed by Contractor differs by more than 25 percent from the estimated quantity of such item indicated in the Agreement; and

2. if there is no corresponding adjustment with respect to any other item of Work; and

3. if Contractor believes that Contractor has incurred additional expense as a result thereof or if Owner believes that the quantity variation entitles Owner to a decrease in the unit price, either party may make a Claim for an adjustment in the Contract Price in

accordance with Article 10 if the parties are unable to agree as to the effect of any such variation in the quantity of Unit Price Work performed.

ARTICLE 12 - CHANGE OF CONTRACT PRICE; CHANGE OF CONTRACT TIMES

12.01 *Change of Contract Price:* The Contract Price may only be changed by a Change Order. Any Claim for an adjustment in the Contract Price shall be based on written notice submitted by the party making the Claim to the Engineer and the other party to the Contract in accordance with the provisions of Paragraph 10.05.

12.02 *Change of Contract Times*

A. The Contract Times may only be changed by a Change Order. Any Claim for an adjustment in the Contract Times shall be based on written notice submitted by the party making the Claim to the Engineer and the other party to the Contract in accordance with the provisions of Paragraph 10.05.

B. Any adjustment of the Contract Times covered by a Change Order or any Claim for an adjustment in the Contract Times will be determined in accordance with the provisions of this Article 12.

12.03 *Delays*

A. Where Contractor is prevented from completing any part of the Work within the Contract Times due to delay beyond the control of Contractor, the Contract Times will be extended in an amount equal to the time lost due to such delay if a Claim is made therefor as provided in Paragraph 12.02.A. Delays beyond the control of Contractor shall include, but not be limited to, acts or neglect by Owner, acts or neglect of utility owners or other contractors performing other work as contemplated by Paragraph 12.03.C, fires, floods, epidemics, abnormal weather conditions, or acts of God. Provided, however, that Contract Times shall not be extended unless the Contractor has fulfilled its obligations under the Contract Documents, including by coordinating with utility owners and other contractors or subcontractors.

B. If Owner, Engineer, or other contractors or utility owners performing other work for Owner as contemplated by Article 7, or anyone for whom Owner is responsible, delays, disrupts, or interferes with the performance or progress of the Work, then Contractor shall be entitled to an equitable adjustment in the Contract Times. Contractor's entitlement to an adjustment of the Contract Times is conditioned on such adjustment being essential to Contractor's ability to complete the Work within the Contract Times.

C. Neither party shall be liable to the other nor deemed to be in breach of this Contract for failure or delay in performance or progress of the Work by fire, flood, epidemic, abnormal weather conditions, acts of God, acts or failures to act of utility owners not under the

control of Owner, or other causes not the fault of and beyond control of Owner and Contractor. In the event of failure or delay for the causes identified in this Paragraph 12.03.C, Contractor shall be entitled to an equitable adjustment in Contract Times, if such adjustment is essential to Contractor's ability to complete the Work within the Contract Times and Contractor promptly notifies Owner of the existence and nature of such failure or delay. Such an adjustment shall be Contractor's sole and exclusive remedy for the delays described in this Paragraph 12.03.C. It is agreed that since the efficiency of performance of this Contract is of the essence, continued failure to perform for periods aggregating thirty (30) or more days, even for causes beyond the control of Contractor, shall afford Owner the right to terminate this Contract without assessment or termination costs or penalties.

D. Owner, Engineer, and their officers, directors, members, partners, employees, agents, consultants, or subcontractors shall not be liable to Contractor for any claims, costs, losses, or damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) sustained by Contractor on or in connection with any other project or anticipated project.

E. Contractor shall not be entitled to an adjustment in Contract Price or Contract Times for delays within the control of Contractor. Delays attributable to and within the control of a Subcontractor or Supplier shall be deemed to be delays within the control of Contractor.

F. In no event shall Owner or Engineer be liable to Contractor, any Subcontractor, any Supplier, or any other person or organization, or any surety for, employee, or agent of any of them, for damages arising out of or resulting from delays caused by or within the control of Contractor or delays beyond the control of both Owner and Contractor, including but not limited to fires, floods, epidemics, abnormal weather conditions, acts of God, or acts or neglect by utility owners or other contractors performing other work as contemplated by Article 7.

G. Notwithstanding anything to the contrary in the Contract Documents, an extension in the Contract Times, to the extent permitted under Paragraphs 12.02 and 12.03, shall be the sole and exclusive remedy of the Contractor for any (1) delay in the commencement, prosecution, or completion of the Work; (2) hindrance or obstruction in the performance of the Work; (3) loss of productivity; or (4) other similar claims (collectively referred to in this paragraph as Delays) whether or not such Delays are foreseeable. In no event shall the Contractor be entitled to any compensation or recovery of any damages, in connection with any Delay, including, without limitation, consequential damages, lost opportunity costs, impact damages, or other similar remuneration. The Owner's exercise of any of its rights or remedies under the Contract Documents (including, without limitation, ordering changes in the Work, directing suspension, rescheduling, or correction of the Work, or terminating this agreement for its convenience), regardless of the extent or frequency of the Owner's exercise of such rights or remedies, shall not be construed as active interference with the Contractor's performance of the Work. If the Contractor submits a progress report indicating, or otherwise expressing an intention to achieve, completion of the Work prior to any completion date required by the Contract Documents or expiration of the contract

Times, no liability of the Owner to the Contractor for any failure of the Contractor to so complete the Work shall be created or implied.

ARTICLE 13 – TESTS AND INSPECTIONS; CORRECTION, REMOVAL, OR ACCEPTANCE OF DEFECTIVE WORK

13.01 *Notice of Defects:* Prompt written notice of all defective Work of which Owner or Engineer has actual knowledge will be given to Contractor. Defective Work may be rejected, corrected, or accepted as provided in this Article 13.

13.02 *Access to Work:* Owner, Engineer, their consultants and other representatives and personnel of Owner, independent testing laboratories, and governmental agencies with jurisdictional interests will have access to the Site and the Work at reasonable times for their observation, inspection, and testing. Contractor shall provide them proper and safe conditions for such access and advise them of Contractor's safety procedures and programs so that they may comply therewith as applicable.

13.03 *Tests and Inspections*

A. Contractor shall give Engineer timely written notice of readiness of the Work for all required inspections, tests, or approvals and shall cooperate with inspection and testing personnel to facilitate required inspections or tests.

B. Contractor shall pay for the services of an independent testing laboratory to perform all inspections, tests, or approvals required by the Contract Documents.

C. If Laws or Regulations of any public body having jurisdiction require any Work (or part thereof) specifically to be inspected, tested, or approved by an employee or other representative of such public body, Contractor shall assume full responsibility for arranging and obtaining such inspections, tests, or approvals, pay all costs in connection therewith, and furnish Engineer the required certificates of inspection or approval.

D. Contractor shall be responsible for arranging and obtaining and shall pay all costs in connection with any inspections, tests, or approvals required for Owner's and Engineer's acceptance of materials or equipment to be incorporated in the Work; or acceptance of materials, mix designs, or equipment submitted for approval prior to Contractor's purchase thereof for incorporation in the Work. Such inspections, tests, or approvals shall be performed by organizations acceptable to Owner and Engineer.

E. If any Work (or the work of others) that is to be inspected, tested, or approved is covered by Contractor without written concurrence of Engineer, Contractor shall, if requested by Engineer, uncover such Work for observation, at Contractor's expense.

13.04 *Uncovering Work*

A. If any Work is covered prior to Engineer's observation or contrary to the request of Engineer, it must, if requested by Engineer, be uncovered for Engineer's observation and replaced at Contractor's expense.

B. If Engineer considers it necessary or advisable that covered Work be observed by Engineer or inspected or tested by others, Contractor, at Engineer's request, shall uncover, expose, or otherwise make available for observation, inspection, or testing as Engineer may require, that portion of the Work in question, furnishing all necessary labor, material, and equipment at Contractor's expense.

C. If it is found that the uncovered Work is defective, Contractor shall pay all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such uncovering, exposure, observation, inspection, and testing, and of satisfactory replacement or reconstruction (including but not limited to all costs of repair or replacement of work of others); and Owner shall be entitled to an appropriate decrease in the Contract Price.

D. If the uncovered Work is not found to be defective, Contractor shall be allowed an increase in the Contract Price or an extension of the Contract Times, or both, directly attributable to such uncovering, exposure, observation, inspection, testing, replacement, and reconstruction, unless the Contractor fails to provide written notice as required in Paragraph 13.03. If the parties are unable to agree as to the amount or extent thereof, Contractor may make a Claim therefor as provided in Paragraph 10.05.

13.05 *Owner May Stop the Work:* If the Work is defective, or Contractor fails to supply sufficient skilled workers or suitable materials or equipment, or fails to perform the Work in such a way that the completed Work will conform to the Contract Documents, Owner may order Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, this right of Owner to stop the Work shall not give rise to any duty on the part of Owner to exercise this right for the benefit of Contractor, any Subcontractor, any Supplier, any other individual or entity, or any surety for, or employee or agent of any of them. If Owner stops Work under this Paragraph, Contractor shall not be entitled to any extension of the Contract Times or increase in the Contract Price in connection therewith.

13.06 *Correction or Removal of Defective Work*

A. Promptly after receipt of written notice, Contractor shall correct all defective Work, whether or not fabricated, installed, or completed, or, if the Work has been rejected by Engineer, remove it from the Project and replace it with Work that is not defective. Contractor shall pay all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such correction or removal (including but not limited to all costs of repair or replacement of work of others).

B. When correcting defective Work under the terms of this Paragraph 13.06 or Paragraph 13.07, Contractor shall take no action that would void or otherwise impair Owner's special warranty and guarantee, if any, on said Work.

13.07 *Correction Period*

A. If within two years after the date of Substantial Completion (or such longer period of time as may be prescribed by the terms of any applicable special guarantee required by the Contract Documents) or by any specific provision of the Contract Documents, any Work is found to be defective, or if the repair of any damages to the land or areas made available for Contractor's use by Owner or permitted by Laws and Regulations as contemplated in Paragraph 6.11.A is found to be defective, Contractor shall promptly, without cost to Owner and in accordance with Owner's written instructions:

1. repair such defective land or areas; or

2. correct such defective Work; or

3. if the defective Work has been rejected by Owner, remove it from the Project and replace it with Work that is not defective, and

4. satisfactorily correct or repair or remove and replace any damage to other Work, to the work of others or other land or areas resulting therefrom.

B. If Contractor does not promptly comply with the terms of Owner's written instructions, or in an emergency where delay would cause serious risk of loss or damage, Owner may have the defective Work corrected or repaired or may have the rejected Work removed and replaced. All claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such correction or repair or such removal and replacement (including but not limited to all costs of repair or replacement of work of others) will be paid by Contractor.

C. In special circumstances where a particular item of equipment is placed in continuous service before Substantial Completion of all the Work, the correction period for that item may start to run from an earlier date if so provided in the Specifications.

D. Where defective Work (and damage to other Work resulting therefrom) has been corrected or removed and replaced under this Paragraph 13.07, the correction period hereunder with respect to such Work will be extended for an additional period of one year after such correction or removal and replacement has been satisfactorily completed.

E. Contractor's obligations under this Paragraph 13.07 are in addition to any other obligation or warranty. The provisions of this Paragraph 13.07 shall not be construed as a substitute for, or a waiver of, the provisions of any applicable statute of limitation or repose.

13.08 *Acceptance of Defective Work:* If, instead of requiring correction or removal and replacement of defective Work, Owner prefers to accept it, Owner may do so. Contractor shall

pay all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) attributable to Owner's evaluation of and determination to accept such defective Work and for the diminished value of the Work to the extent not otherwise paid by Contractor pursuant to this sentence. If any such acceptance occurs prior to Engineer's recommendation of final payment, a Change Order will be issued incorporating the necessary revisions in the Contract Documents with respect to the Work, and Owner shall be entitled to an appropriate decrease in the Contract Price, reflecting the diminished value of Work so accepted. If the acceptance occurs after such recommendation, an appropriate amount will be paid by Contractor to Owner.

13.09 *Owner May Correct Defective Work*

A. If Contractor fails within a reasonable time after written notice from Engineer to correct defective Work, or to remove and replace rejected Work as required in accordance with Paragraph 13.06.A, or if Contractor fails to perform the Work in accordance with the Contract Documents, or if Contractor fails to comply with any other provision of the Contract Documents, Owner may, after seven days written notice to Contractor, correct, or remedy any such deficiency.

B. In connection with such corrective or remedial action, Owner may exclude Contractor from all or part of the Site, take possession of all or part of the Work and suspend Contractor's services related thereto, take possession of Contractor's tools, appliances, construction equipment and machinery at the Site, and incorporate in the Work all materials and equipment stored at the Site or for which Owner has paid Contractor but which are stored elsewhere. Contractor shall allow Owner, Owner's representatives, agents and employees, Owner's other contractors, and Engineer and Engineer's consultants access to the Site to enable Owner to exercise the rights and remedies under this Paragraph.

C. All claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) incurred or sustained by Owner in exercising the rights and remedies under this Paragraph 13.09 will be charged against Contractor, and a Change Order will be issued incorporating the necessary revisions in the Contract Documents with respect to the Work; and Owner shall be entitled to an appropriate decrease in the Contract Price. If the parties are unable to agree as to the amount of the adjustment, Owner may make a Claim therefor as provided in Paragraph 10.05. Such claims, costs, losses and damages will include but not be limited to all costs of repair, or replacement of work of others destroyed or damaged by correction, removal, or replacement of Contractor's defective Work.

D. Contractor shall not be allowed an extension of the Contract Times because of any delay in the performance of the Work attributable to the exercise by Owner of Owner's rights and remedies under this Paragraph 13.09.

ARTICLE 14 – PAYMENTS TO CONTRACTOR AND COMPLETION

14.01 *Schedule of Values:* The Price Sheet and, if applicable, the Schedule of Values established as provided in Paragraph 2.03.B.3, will serve as the basis for progress payments and will be incorporated into a form of Application for Payment acceptable to Engineer. Progress payments on account of Unit Price Work will be based on the number of units completed.

14.02 *Progress Payments*

A. *Applications for Payments:*

1. At least 20 days before the date established in the Agreement for each progress payment (but not more often than once a month), Contractor shall prepare and submit to the Owner and Engineer for review a draft Application for Payment covering the Work completed as of the date of the Application and accompanied by such supporting documentation as is required by the Contract Documents. If payment is requested on the basis of materials and equipment not incorporated in the Work but delivered and suitably stored at the Site or at another location agreed to in writing, the draft Application for Payment shall also be accompanied by a bill of sale, invoice, or other documentation warranting that Owner has received the materials and equipment free and clear of all Liens and evidence that the materials and equipment are covered by appropriate property insurance or other arrangements to protect Owner's interest therein, all of which must be satisfactory to Owner.

2. If Engineer and Owner approve the draft Application for Payment as per Section 14.02.B, the Contractor shall submit a Final, signed Application for Payment to the Engineer. The Engineer shall, upon approval of the Final Application for Payment, sign and send the approved Final Application for Payment to the City within 5 days.

3. Each Draft and Final Application for payment shall be accompanied by the following, all in form and substance satisfactory to the Owner:

    a. A current Contractor's lien waiver and duly executed and acknowledged sworn statement showing all Subcontractors and material suppliers with whom the Contractor has entered into Subcontracts, the amount of each such Subcontract, the amount requested for any subcontractor and material supplier in the requested progress payment, and the amount to be paid to the Contractor from such progress payment, together with similar sworn statements from all such Subcontractors and material suppliers;

    b. Duly executed waivers of mechanics' and material suppliers' liens from all Subcontractors and, where applicable, from material suppliers establishing payment or satisfaction of payment of all amounts requested by the Contractor on behalf of such entities or persons in any previous application for payment; and

    c. All information and materials required to comply with the requirements of the Contract Documents or reasonably requested by the Owner or the Engineer.

d. Contractor shall furnish evidence that payment received on the basis of materials and equipment not incorporated and suitably stored, has in fact been paid to the respective supplier(s) within sixty (60) days of payment by Owner.

4. Beginning with the second Application for Payment, each Application shall include an affidavit of Contractor stating that all previous progress payments received on account of the Work have been applied on account to discharge Contractor's legitimate obligations associated with prior Applications for Payment.

5. The amount of retainage with respect to progress payments will be 5 percent. No payments will be made that would deplete the retainage, place in escrow any funds that are required for retainage, or invest the retainage for the benefit of the Contractor.

B. *Review of Applications:*

1. Engineer will, within 5 days after receipt of each Draft Application for Payment and supporting documentation, either indicate in writing a recommendation of payment and present the Application to Owner for review or return the Application to Contractor indicating in writing Engineer's reasons for refusing to recommend payment. In the latter case, Contractor may make the necessary corrections and resubmit the Draft Application.

2. Neither Engineer's review of Contractor's Work for the purposes of recommending payments nor Engineer's recommendation of any payment, including final payment, will impose responsibility on Engineer:

a. to supervise, direct, or control the Work, or

b. for the means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or

c. for Contractor's failure to comply with Laws and Regulations applicable to Contractor's performance of the Work, or

d. to make any examination to ascertain how or for what purposes Contractor has used the moneys paid on account of the Contract Price, or

e. to determine that title to any of the Work, materials, or equipment has passed to Owner free and clear of any Liens.

3. Engineer may refuse to recommend any such payment or, because of subsequently discovered evidence or the results of subsequent inspections or tests, revise or revoke any such payment recommendation previously made, to such extent as may be necessary in Engineer's opinion to protect Owner from loss because:

a. the Work is defective, or completed Work has been damaged, requiring correction or replacement;

b. the Contract Price has been reduced by Change Orders;

c. Owner has been required to correct defective Work or complete Work in accordance with Paragraph 13.09; or

d. Engineer has actual knowledge of the occurrence of any of the events enumerated in Paragraph 15.02.A.

C. *Payment Becomes Due:* Ten days after presentation of the Final Application for Payment (as signed by Engineer) and all supporting documentation required under the Contract Documents to Owner with Engineer's recommendation, the amount recommended will (subject to the provisions of Paragraph 14.02.D) become due, and when due will be paid by Owner to Contractor.

D. *Reduction in Payment:*

1. Owner may refuse to make payment of the full amount recommended by Engineer because:

a. claims have been made against Owner on account of Contractor's performance or furnishing of the Work;

b. Liens have been filed in connection with the Work, except where Contractor has delivered a specific bond satisfactory to Owner to secure the satisfaction and discharge of such Liens;

c. there are other items entitling Owner to a set-off against the amount recommended;

d. Owner has actual knowledge of the occurrence of any of the events enumerated in Paragraph 15.02.A; or

e. The Final Application for Payment is submitted without all supporting documentation required under the Contract Documents.

2. If Owner refuses to make payment of the full amount recommended by Engineer, Owner will give Contractor immediate written notice (with a copy to Engineer) stating the reasons for such action and promptly pay Contractor any amount remaining after deduction of the amount so withheld. Owner shall promptly pay Contractor the amount so withheld, or any adjustment thereto agreed to by Owner and Contractor, when Contractor remedies the reasons for such action.

14.03 *Contractor's Warranty of Title*

A. Contractor warrants and guarantees that title to all Work, materials, and equipment covered by any Application for Payment, whether incorporated in the Project or not, will pass to Owner no later than the time of payment free and clear of all Liens.

B. No materials or supplies for the Work shall be purchased by Contractor or any Subcontractor subject to any chattel or mortgage or under a conditional sale contract or other agreement by which an interest is retained by the seller. Contractor warrants that Contractor has good title to all materials and supplies used by Contractor in the Work, free from all liens, claims, or encumbrances.

C. Contractor shall at Owner's request furnish satisfactory evidence that all obligations of the nature hereinabove described have been paid, discharged, or waived. If Contractor fails to do so, Owner may, after written notice, either pay unpaid bills, direct or withhold from Contractor's unpaid compensation a sum of money deemed reasonably sufficient to pay any and all such lawful claims until satisfactory evidence is furnished that all liabilities have been fully discharged whereupon payment to Contractor shall be resumed in accordance with the terms of the Agreement, but in no event shall the provisions of this Paragraph be construed to impose any obligations upon Owner to either Contractor or Contractor's Surety. In paying any unpaid bills of Contractor, Owner shall be deemed the agent of Contractor, and any payment made by Owner shall be considered as payment made under the Contractor by Owner to Contractor. Owner shall not be liable to Contractor for any such payment made in good faith.

D. The Contractor further expressly undertakes to defend the Owner and Engineer, at the Contractor's sole expense, against any actions, lawsuits, or proceedings brought against the Owner, Engineer, or any third party as a result of liens filed against the Work, the site of any of the Work, the project site and any improvements thereon, payments due the Contractor, or any portion of the property of the Owner, Engineer, or third party. The Contractor hereby agrees to indemnify and hold the Owner, Engineer, and third parties harmless against any such liens or claims of lien and agrees to pay any judgment or lien resulting from any such action, lawsuit, or proceeding.

E. The Contractor agrees to waive any right that it may have to assert a mechanic's or other lien against the Project Site and any improvements thereon, including, without limitation, the Work itself. Furthermore, the Contractor will cause a similar provision, waiving all right to a mechanic's or other lien against the property, to be included in all of its subcontracts, any sub-subcontracts, and all contracts with material suppliers.

14.04 *Substantial Completion*

A. When Contractor considers the entire Work substantially complete as defined in the Contract Documents, Contractor shall present to Owner and Engineer certification in writing that the entire Work is substantially complete (except for items specifically listed by Contractor as incomplete) and request that Engineer issue a certificate of Substantial Completion.

B. Subject to the procedures set forth in this Paragraph 14.04, within 21 days after presentation of Contractor's certification, Engineer on behalf of Owner shall present to Contractor either a written declaration that the Work has been Substantially Completed or an itemized list of incomplete or unsatisfactory work items required by the Contract

sufficient to demonstrate that the Work has not be Substantially Completed. Engineer's declaration shall be made in accordance with the following procedures:

1. Promptly after Contractor's notification, Owner, Contractor, and Engineer shall make an inspection of the Work to determine the status of completion. If Engineer does not consider the Work substantially complete, Engineer will notify Contractor in writing within 10 days of the Contractor's presentation of the certification required under Paragraph 14.04.A, giving the reasons therefor.

2. If Engineer considers the Work substantially complete, Engineer will, within 10 days of the Contractor's presentation of the certification required under Paragraph 14.04.A, deliver to Owner a tentative certificate of Substantial Completion which shall fix the date of Substantial Completion. There shall be attached to the certificate a tentative list of items to be completed or corrected before final payment. Owner shall have seven days after receipt of the tentative certificate during which to make written objection to Engineer as to any provisions of the certificate or attached list. If, after considering such objections, Engineer concludes that the Work is not substantially complete, Engineer will, within 21 days after presentation of Contractor's certification under Paragraph 14.04.A, notify Contractor in writing, stating the reasons therefor and providing an itemized list of incomplete or unsatisfactory Work items required by the Contract. If, after consideration of Owner's objections, Engineer considers the Work substantially complete, Engineer will, within said 21 days, execute and deliver to Owner and Contractor a definitive certificate of Substantial Completion (with a revised tentative list of items to be completed or corrected) reflecting such changes from the tentative certificate as Engineer believes justified after consideration of any objections from Owner.

3. At the time of Engineer's delivery of the tentative certificate of Substantial Completion to Owner, Engineer will deliver to Owner and Contractor a written recommendation as to division of responsibilities pending final payment between Owner and Contractor with respect to security, operation, safety, and protection of the Work, maintenance, heat, utilities, insurance, and warranties and guarantees. Unless Owner and Contractor agree otherwise in writing and so inform Engineer in writing prior to Engineer's issuing the definitive certificate of Substantial Completion, Engineer's aforesaid recommendation will be binding on Owner and Contractor until final payment.

C. Owner shall have the right to exclude Contractor from the Site after the date of Substantial Completion subject to allowing Contractor reasonable access to remove its property and complete or correct items on the tentative list.

D. Engineer shall be entitled to withhold certification of Substantial Completion if Contractor has not brought all substantially completed Work to functioning condition to the satisfaction of Owner, provided training to Owner to the satisfaction of Owner on all substantially completed Work, or provided all necessary documentation for operation and maintenance of all substantially completed Work including, but not limited to, final manufacturer's operation and maintenance manuals.

E. Within 15 days after the effective date of the declaration of Substantial Completion, Owner shall send to Contractor by certified mail, return receipt requested, a complete list of all incomplete or unsatisfactory work items, and, unless delayed by causes beyond its control, Contractor shall complete all work items within 45 days after the receipt of such list or before the then Contract Completion Date, whichever is later. If Contractor fails to complete such work within such time, Owner may, subsequent to 7 days' written notice to Contractor by certified mail, return receipt requested, terminate the Contract and complete the incomplete or unsatisfactory work items and charge the cost of same to Contractor.

F. Within 65 days after the effective date of the declaration of Substantial Completion, Owner shall prepare and forthwith send to Contractor for acceptance a Substantial Completion estimate for the quantity and price of the Work done and all but one percent retainage on that Work, including the quantity, price, and all but one percent retainage for the undisputed part of each Work item and extra Work item in dispute but excluding the disputed part thereof, less the estimated cost of completing all incomplete and unsatisfactory Work items and less the total periodic payments made to date for the Work. Owner shall also deduct from the Substantial Completion estimate an amount equal to the sum of all demands for direct payment filed by Subcontractors and not yet paid to Subcontractors or deposited in joint accounts pursuant to G.L. c. 30, §39F.

14.05 *Partial Utilization*

A. Prior to Substantial Completion of all the Work, Owner may use or occupy any substantially completed part of the Work which has specifically been identified in the Contract Documents, or which Owner, Engineer, and Contractor agree constitutes a separately functioning and usable part of the Work that can be used by Owner for its intended purpose without significant interference with Contractor's performance of the remainder of the Work, subject to the following conditions:

1. Owner at any time may request Contractor in writing to permit Owner to use or occupy any such part of the Work which Owner believes to be ready for its intended use and substantially complete. If and when Contractor agrees that such part of the Work is substantially complete, Contractor, Owner, and Engineer will follow the procedures of Paragraph 14.04.A through D for that part of the Work.

2. If Contractor considers any such part of the Work ready for its intended use and substantially complete, the Contractor must follow the procedures of Paragraph 14.04.A through D to receive the Owner's and Engineer's certification of Substantial Completion for that part of the Work.

3. Owner may at any time request Contractor in writing, with a copy to Engineer, to permit Owner to take over operation of any part of the Work although it is not substantially complete. Within a reasonable time after such written notice, Owner, Contractor, and Engineer shall make an inspection of that part of the Work to determine its status of completion and will prepare a list of items remaining to be completed or corrected thereon before final payment. If Contractor does not object in writing to Owner and Engineer that such part of the Work is not ready for separate operation by

Owner, Engineer will finalize the list of items to be completed or corrected and will deliver such list to Owner and Contractor together with a written recommendation as to the division of responsibilities pending final payment between Owner and Contractor with respect to security, operation, safety, maintenance, utilities, insurance, warranties, and guarantees for that part of the Work, which will become binding upon Owner and Contractor at the time when Owner takes over such operation (unless they shall have otherwise agreed in writing and so informed Engineer). During such operation and prior to substantial completion of such part of the Work, Owner shall allow Contractor reasonable access to complete or correct items on said list and to complete other related Work.

14.06 *Final Completion*

A. Upon written notice from Contractor to Owner and Engineer that the entire Work or an agreed portion thereof is complete, Engineer will promptly make a final inspection with Owner and Contractor. The Engineer shall, within 30 days of its and the Owner's receipt of Contractor's written notice, notify Contractor in writing of all particulars in which this inspection reveals that the Work is incomplete or defective. Contractor shall immediately take such measures as are necessary to complete such Work or remedy such deficiencies. If Owner and Engineer agree that the Work is complete, the Contractor shall receive a copy of the Engineer's certificate of final inspection within 30 days of the Engineer's and Owner's receipt of the written notice provided by Contractor under this sub-paragraph.

B. Within 30 days after receipt by Owner of notice from Contractor that the entire Work is complete, Owner shall prepare and forthwith send to Contractor for acceptance a final estimate for the quantity and price of the Work done and all retainage on that Work less all payments made to date, unless Owner's inspection shows that Work items required by the Contract remain incomplete or unsatisfactory, or that documentation required by the Contract has not been completed.

14.07 *Final Payment*

A. *Application for Payment:*

1. Pursuant to Paragraph 14.06, and after the Contractor has delivered, in accordance with the Contract Documents, all maintenance and operating instructions, schedules, guarantees, bonds, certificates or other evidence of insurance, certificates of inspection, marked-up record documents (as provided in Paragraph 6.12), and other documents, Contractor may make application for final payment following the procedures set forth in Paragraph 14.02 for progress payments.

2. The final Application for Payment shall be accompanied (except as previously delivered) by:

a. all documentation called for in the Contract Documents, including but not limited to the evidence of insurance required by Paragraph 5.04 and the Final Payment Release Form;

b. consent of the surety, if any, to final payment;

c. a list of all Claims against Owner that Contractor believes are unsettled; and

d. complete and legally effective releases or waivers (satisfactory to Owner) of all Lien rights arising out of or Liens filed in connection with the Work, in addition to any release language set forth in the Final Payment Release Form.

3. In lieu of the releases or waivers of Liens specified in Paragraph 14.07.A.2 and as approved by Owner, Contractor may furnish receipts or releases in full and an affidavit of Contractor that: (i) the releases and receipts include all labor, services, material, and equipment for which a Lien could be filed; and (ii) all payrolls, material and equipment bills, and other indebtedness connected with the Work for which Owner might in any way be responsible, or which might in any way result in liens or other burdens on Owner's property, have been paid or otherwise satisfied. If any Subcontractor or Supplier fails to furnish such a release or receipt in full, Contractor may furnish a bond or other collateral satisfactory to Owner to indemnify Owner against any Lien.

B. *Engineer's Review of Application and Acceptance:* Upon the Owner's and Engineer's receipt of the Contractor's Final Application for Payment in accordance with Paragraph 14.07.A, the Engineer shall review the application following the procedures set forth in Paragraph 14.02 for progress payments. Any approval, acceptance or recommendation by Engineer shall be fully subject to Paragraph 14.09.

C. *Payment Becomes Due:* Thirty days after the presentation to Owner of the Final Application for Payment (as signed by the Engineer) and accompanying documentation, the amount recommended by Engineer, less any sum Owner is entitled to set off against Engineer's recommendation, including but not limited to liquidated damages, will become due and will be paid by Owner to Contractor.

14.08 *Final Completion Delayed:* If, through no fault of Contractor, final completion of the Work is significantly delayed, and if Engineer so confirms, Owner shall, upon receipt of Contractor's final Application for Payment (for Work fully completed and accepted) and recommendation of Engineer, and without terminating the Contract, make payment of the balance due for that portion of the Work fully completed and accepted. If the remaining balance to be held by Owner for Work not fully completed or corrected is less than the retainage stipulated in the Agreement, and if bonds have been furnished as required in Paragraph 5.01, the written consent of the surety to the payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by Contractor to Engineer with the Application for such payment. Such payment shall be made under the terms and conditions governing final payment, except that it shall not constitute a waiver of Claims.

14.09 *Waiver of Claims*

A. The making and acceptance of final payment will constitute:

1. a waiver of all Claims by Owner against Contractor, except Claims arising from unsettled Liens, from defective Work appearing after final inspection pursuant to Paragraph 14.06, from failure to comply with the Contract Documents or the terms of any special guarantees specified therein, or from Contractor's continuing obligations under the Contract Documents; and

2. a waiver of all Claims by Contractor against Owner other than those previously made in accordance with the requirements herein and expressly acknowledged by Owner in writing as still unsettled.

ARTICLE 15 – SUSPENSION OF WORK AND TERMINATION

15.01 *Owner May Suspend Work*

A. Owner may order, at any time and without cause, suspension of the Work in accordance with the following provisions of Massachusetts General Laws, Chapter 30, Section 39O:

(a) The Owner may 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 to be appropriate for the convenience of the Owner; provided however, that if there is a suspension, delay or interruption for fifteen days or more or due to a failure of the Owner to act within the time specified in this contract, the Owner shall make an adjustment in the contract price for any increase in the cost of performance of this contract but shall not include any profit to the Contractor on such increase; and provided further, that the Owner shall not make any adjustment in the contract price 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 price under any other contract provisions.

(b) The Contractor must submit the amount of a claim under provision (a) 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.

15.02 *Owner May Terminate for Cause*

A. The occurrence of any one or more of the following events will justify termination for cause:

1. Contractor's persistent failure to perform the Work in accordance with the Contract Documents (including, but not limited to, failure to supply sufficient skilled workers or suitable materials or equipment or failure to adhere to the Progress Schedule

established under Paragraph 2.03 as adjusted from time to time pursuant to Paragraph 6.04);

2. Contractor's disregard of Laws or Regulations of any public body having jurisdiction;

3. Contractor's repeated disregard of the authority of Owner or Engineer; or

4. Contractor's violation in any substantial way of any provisions of the Contract Documents.

B. If one or more of the events identified in Paragraph 15.02.A occur, Owner may, after giving Contractor seven days written notice of its intent to terminate the services of Contractor:

1. exclude Contractor from the Site, and take possession of the Work and of all Contractor's tools, appliances, construction equipment, and machinery at the Site, and use the same to the full extent they could be used by Contractor (without liability to Contractor for trespass or conversion);

2. incorporate in the Work all materials and equipment stored at the Site or for which Owner has paid Contractor but which are stored elsewhere; and

3. complete the Work as Owner may deem expedient.

C. If Owner proceeds as provided in Paragraph 15.02.B, Contractor shall not be entitled to receive any further payment until the Work is completed. If the unpaid balance of the Contract Price exceeds all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) sustained by Owner arising out of or relating to completing the Work, such excess will be paid to Contractor. If such claims, costs, losses, and damages exceed such unpaid balance, Contractor shall pay the difference to Owner. Such claims, costs, losses, and damages incurred by Owner will be reviewed by Engineer as to their reasonableness and, when so approved by Engineer, incorporated in a Change Order. When exercising any rights or remedies under this Paragraph, Owner shall not be required to obtain the lowest price for the Work performed.

D. Where Contractor's services have been so terminated by Owner, the termination will not affect any rights or remedies of Owner against Contractor then existing or which may thereafter accrue. Any retention or payment of moneys due Contractor by Owner will not release Contractor from liability.

15.03 *Owner's Termination for Convenience*

A. The Owner may, at any time, terminate the Contract in whole or in part for the Owner's convenience and without cause. Termination by the Owner under this paragraph shall be by a notice of termination delivered to the Contractor specifying the extent of termination and the effective date.

B. Upon receipt of a notice of termination for convenience, the Contractor shall immediately, in accordance with instructions from the Owner, proceed with performance of the following duties regardless of delay in determining or adjusting amounts due under this paragraph:

1. Cease operations as specified in the notice;

2. Place no further orders and enter into no further subcontracts for materials, labor, services, or facilities except as necessary to complete continued portions of the Contract;

3. Terminate all subcontracts and orders to the extent they relate to the Work terminated;

4. Proceed to complete the performance of Work not terminated; and

5. Take actions that may be necessary, or that the Owner may direct, for the protection and preservation of the terminated Work.

C. Upon such termination, the Contractor shall recover as its sole remedy payment of the percentage of the Contract Price equal to the percentage of the work performed satisfactorily and not previously paid for as determined by the Engineer. The Contractor hereby waives and forfeits all other claims for payment and damages, including, without limitation, anticipated profits or revenue or other economic loss arising out of or resulting from such termination.

D. The Owner shall be credited for (1) payments previously made to the Contractor for the terminated portion of the Work; (2) claims that the Owner has against the Contractor under the Contract; and (3) the value of the materials, supplies, equipment, or other items that are to be disposed of by the Contractor that are part of the Contract Price.

ARTICLE 16 – DISPUTE RESOLUTION

16.01 *Methods and Procedures*

A. Either Owner or Contractor may request mediation of any Claim submitted to Engineer for a decision under Paragraph 10.05 before such decision becomes final and binding. Owner may deny any such request from the Contractor. The mediation will be governed by the Construction Industry Mediation Rules of the American Arbitration Association in effect as of the Effective Date of the Agreement. The request for mediation shall be submitted in writing to the American Arbitration Association. Timely submission of the request shall stay the effect of Paragraph 10.05.E.

B. Owner and Contractor shall participate in the mediation process in good faith. The process shall be concluded within 60 days of filing of the request. The date of termination of the mediation shall be determined by application of the mediation rules referenced above.

C. If the Claim is not resolved by mediation, the decision under Paragraph 10.05.C or a denial pursuant to Paragraphs 10.05.C.3 or 10.05.D shall become final and binding 30 days after termination of the mediation unless, within that time period, Owner or Contractor:

1. elects in writing to invoke any dispute resolution process provided for in the Supplementary Conditions; or

2. agrees with the other party to submit the Claim to another dispute resolution process; or

3. gives written notice to the other party of the intent to submit the Claim to a court of competent jurisdiction.

D. Contractor shall carry on the Work and maintain the progress schedule during the dispute resolution proceedings unless otherwise agreed in writing by Owner and Contractor.

ARTICLE 17 – MISCELLANEOUS

17.01 *Giving Notice*

A. Whenever any provision of the Contract Documents requires the giving of written notice, it will be deemed to have been validly given if:

1. delivered in person to the individual or to a member of the firm or to an officer of the corporation for whom it is intended; or

2. delivered at or sent by registered or certified mail, postage prepaid, to the last business address known to the giver of the notice.

B. Contractor's business address and his office at or near the Site are both hereby designated as places to which communications may be delivered. The depositing of any letter, notice, or other communication in a postpaid wrapper directed to the Contractor's business address in a post office box regularly maintained by the Post Office or the delivery at either designated address of any letter, notice, or other communication by mail or otherwise shall be deemed sufficient service thereof upon Contractor, and the date of such service shall be the date of receipt. The first-named address may be changed at any time by an instrument in writing, executed and acknowledged by Contractor and delivered to Engineer. Service of any notice, letter, or other communication upon Contractor personally shall likewise be deemed sufficient service.

17.02 *Computation of Times:* When any period of time is referred to in the Contract Documents by days, it will be computed to exclude the first and include the last day of such period. If the last day of any such period falls on a Saturday or Sunday or on a day made a legal holiday by the law of the applicable jurisdiction, such day will be omitted from the computation.

17.03 *Cumulative Remedies:* The duties and obligations imposed by these General Conditions and the rights and remedies available hereunder to the parties hereto are in addition to, and are not to be construed in any way as a limitation of, any rights and remedies available to any or all of them which are otherwise imposed or available by Laws or Regulations, by special warranty

or guarantee, or by other provisions of the Contract Documents. The provisions of this Paragraph will be as effective as if repeated specifically in the Contract Documents in connection with each particular duty, obligation, right, and remedy to which they apply.

17.04 *Survival of Obligations:* All representations, indemnifications, warranties, and guarantees made in, required by, or given in accordance with the Contract Documents, as well as all continuing obligations indicated in the Contract Documents, will survive final payment, completion, and acceptance of the Work or termination or completion of the Contract or termination of the services of Contractor.

17.05 *Controlling Law*

A. This Contract is to be governed by the law of the Commonwealth of Massachusetts.

B. All provisions of law required to be incorporated by reference are hereby deemed incorporated, including but not limited to the following:

M.G.L. c. 30, §39F Payment to Subcontractor

M.G.L. c. 30, §39I Deviation from Plans and Specifications

M.G.L. c. 30, §39J No Arbitrary Decisions are Final

M.G.L. c. 30, §39L Construction Work by Foreign Corporations

M.G.L. c. 30, §39M(b) Substitution of Equal Products

M.G.L. c. 30, §39N Differing Site Conditions

M.G.L. c. 30, §39O Equitable Adjustment for Delays

M.G.L. c. 30, §39P Decision on Interpretation of Specifications

M.G.L. c. 30, §39R Contractor's Records

M.G.L. c. 149, §34 Limitations on Hours of Work

M.G.L. c. 149, §44J Advertising Invitations to Bid

M.G.L. c. 82, §40 Excavations; Notice; Penalties

17.06 *Headings:* Article and paragraph headings are inserted for convenience only and do not constitute parts of these General Conditions.

SECTION F: SUPPLEMENTARY CONDITIONS

SUPPLEMENTARY CONDITIONS TO THE STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT – HORIZONTAL CONSTRUCTION

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These Supplementary Conditions amend or supplement the Standard General Conditions of the Construction Contract. All provisions which are not so amended or supplemented remain in full force and effect.

The terms used in the Supplementary Conditions have the meanings stated in the General Conditions. Additional terms used in these Supplementary Conditions have the meanings stated below, which are applicable to both the singular and plural thereof.

The address system used in the Supplementary Conditions is the same as the address system used in the General Conditions, with the prefix "SC" added thereto.

SC-4.06 Hazardous Environmental Conditions at Site

Add the following subparagraphs 4.06.A.1 and 4.06.A.2:

1. The following reports regarding Hazardous Environmental Conditions at the Site are known to Owner:

    a. Report dated April 23, 2019, prepared by BETA Group Inc.
    b. Report dated July 6, 2017, prepared by Nobi Engineering, Inc.

SC-9.03 Project Representative

Add the following new paragraphs immediately after Paragraph 9.03:

B. The Resident Project Representative (RPR) will be Engineer's employee or agent at the Site, will act as directed by and under the supervision of Engineer, and will confer with Engineer regarding RPR's actions. RPR's dealings in matters pertaining to the Work in general shall be with Engineer and Contractor. RPR's dealings with Subcontractors shall be through or with the full knowledge of Contractor. The RPR shall:

    1. *Schedules:* Review the progress schedule, schedule of Shop Drawing and Sample submittals, and schedule of values prepared by Contractor and consult with Engineer concerning acceptability.

    2. *Conferences and Meetings:* Attend meetings with Contractor, such as preconstruction conferences, progress meetings, job conferences and other project-related meetings, and prepare and circulate copies of minutes thereof.

    3. *Liaison:*

        a. Serve as Engineer's liaison with Contractor, working principally through Contractor's authorized representative, assist in providing information regarding the intent of the Contract Documents.

        b. Assist Engineer in serving as Owner's liaison with Contractor.

c. Assist in obtaining from Owner additional details or information, when required for proper execution of the Work.

4. *Interpretation of Contract Documents:* Report to Engineer when clarifications and interpretations of the Contract Documents are needed and transmit to Contractor clarifications and interpretations as issued by Engineer.

5. *Shop Drawings and Samples:*

   a. Record date of receipt of Samples and approved Shop Drawings.

   b. Receive Samples which are furnished at the Site by Contractor, and notify Engineer of availability of Samples for examination.

6. *Modifications:* Consider and evaluate Contractor's suggestions for modifications in Drawings or Specifications and report such suggestions, together with RPR's recommendations, to Engineer. Transmit to Contractor in writing decisions as issued by Engineer.

7. *Review of Work and Rejection of Defective Work:*

   a. Conduct on-Site observations of Contractor's work in progress to assist Engineer in evaluating whether the Work is in general proceeding in accordance with the Contract Documents.

   b. Report to Engineer whenever RPR believes that any part of Contractor's work in progress will not produce a completed Project that conforms generally to the Contract Documents or will imperil the integrity of the design concept of the completed Project as a functioning whole as indicated in the Contract Documents, or has been damaged, or does not meet the requirements of any inspection, test, or approval required to be made; and advise Engineer of that part of work in progress that RPR believes should be corrected or rejected or should be uncovered for observation, or requires special testing, inspection, or approval.

8. *Inspections, Tests, and System Startups:*

   a. Verify that tests, equipment, and system start-ups and operating and maintenance training are conducted in the presence of appropriate Owner's personnel, and that Contractor maintains adequate records thereof.

   b. Observe, record, and report to Engineer appropriate details relative to the test procedures and system start-ups.

9. *Records:*

a. Record names, addresses, fax numbers, e-mail addresses, web site locations, and telephone numbers of all Contractors, Subcontractors, and major Suppliers of materials and equipment.

b. Maintain records for use in preparing Project documentation.

10. *Reports:*

a. Furnish to Engineer periodic reports as required of progress of the Work and of Contractor's compliance with the progress schedule and schedule of Shop Drawing and Sample submittals.

b. Draft and recommend to Engineer proposed Change Orders, Work Change Directives, and Field Orders. Obtain backup material from Contractor.

c. Immediately notify Engineer of the occurrence of any Site accidents, emergencies, acts of God endangering the Work, damage to property by fire or other causes, or the discovery of any Hazardous Environmental Condition.

11. *Payment Requests:* Review draft and final Applications for Payment with Contractor for compliance with the established procedure for their submission and forward with recommendations to Engineer, noting particularly the relationship of the payment requested to the schedule of values, Work completed, and materials and equipment delivered at the Site but not incorporated in the Work.

12. *Certificates, Operation and Maintenance Manuals:* During the course of the Work, verify that materials and equipment certificates, operation and maintenance manuals and other data required by the Specifications to be assembled and furnished by Contractor are applicable to the items actually installed and in accordance with the Contract Documents, and have these documents delivered to Engineer for review and forwarding to Owner prior to payment for that part of the Work.

13. *Completion:*

a. Participate in a Substantial Completion inspection, assist in determination of Substantial Completion and the preparation of lists of items to be completed or corrected.

b. Participate in a final inspection in the company of Engineer, Owner, and Contractor and prepare a final list of items to be completed and deficiencies to be remedied.

c. Observe whether all items on the final list have been completed or corrected and make recommendations to Engineer concerning acceptance and issuance of the Notice of Acceptability of the Work.

C. None of the RPR's activities shall be construed as authorizing any deviation from the Contract Documents or substitution of materials or equipment (including "or-equal" items); undertaking any of the responsibilities of Contractor, Subcontractors, Suppliers, or Contractor's superintendent; advising on, issuing directions relative to, or assuming control over any aspect of the means, methods, techniques, sequences, or procedures of Contractor's work unless such advice or directions are specifically required by the Contract Documents; advising on, issuing directions regarding, or assuming control over safety practices, precautions, and programs in connection with the activities or operations of Owner or Contractor; accepting Shop Drawing or Sample submittals from anyone other than Contractor; or authorizing Owner to occupy the Project in whole or in part.

SECTION G: SPECIFICATIONS

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DIVISION 01

SECTION 01010

SUMMARY OF WORK

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Work covered by the Contract, listing of Owner, Project location, Engineer. Sequence requirements, the Contractor's use of the premises and Owner's occupancy requirements.

1.02 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work includes, but is not necessarily limited to:

- Demolition of existing water pump station components including:
  - Pump station building complete (except for the concrete foundation)
  - One (1) 75-hp and two (2) 100-hp centrifugal horizontal, split case water pumps, piping, valves and appurtenances.
  - One (1) 270-hp engine driven centrifugal horizontal, split case water pump, piping, valves and appurtenances.
  - Standby diesel fired engine and appurtenances
  - Exterior diesel fuel storage tank, concrete pad and appurtenances
  - Electric components, including the motor control center, incoming power supply, lighting, switches, and power receptacles
- Construction of a new water pump station components including:
  - Pump station structure complete
  - Three (3) 100-hp centrifugal vertical, split case water pumps, piping, valves and appurtenances
  - Electrical components, including variable frequency drives, incoming power supply, lighting, switches, and power receptacles
  - Exterior standby engine/generator with integral diesel fuel storage tank, piping, valves and appurtenances
  - Instrumentation and control equipment
  - Remove and replace paving
  - Restoration of all disturbed areas
- Construction of a temporary water bypass system, including connections to the existing underground supply and discharge piping.
- Hazardous Material Abatement
- Roof Replacement at the Saxonville Pump Station
- All related civil, architectural, structural, heating and ventilation, plumbing, electrical and instrumentation control work, yard piping and site work all as more particularly indicated, shown or described in the Drawings, Specifications, and other Contract Documents.

1.03 OWNER

A. City of Framingham DPW

110 Western Avenue
Framingham, Ma 01702
Telephone: (508) 532-6039
Fax: (508) 620-4884
Contact: Julie Liu, P.E.
Senior Project Manager - Utilities

1.04 PROJECT LOCATION

A. 663 Edgell Road
Framingham, MA 01702

1.05 ENGINEER

A. BETA Group, Inc.
701 George Washington Highway
Lincoln, Rhode Island 02865
Telephone: 401-333-2382
Fax: 401-333-9225
Contact: James Dyment, P.E.

1.06 WORK SEQUENCE

A. In order that Work may be conducted with minimum inconvenience to the public and, work under this Contract may be coordinated with other work which may be under construction or contemplated, and that work under the Contract may conform to conditions which it has been undertaken or conditions attached to a right-of-way or particular location for this work, the Engineer may determine the point or points and time or times when portions of work will commence or be carried on and may issue orders pertaining to the work sequence, relative to the rate of progress on several portions of the work.

1.07 CONTRACTOR USE OF PREMISES

A. The Contractor's use of premises shall be within the limits shown on the Drawings and as defined in the Contract Agreement, for the performance of the Work.

B. The Contractor shall assume full responsibility for security of all materials and equipment on the site, including those of his subcontractor's.

C. If directed by the Owner, the Contractor shall move any stored items that interfere with operations of the Owner.

D. Obtain and pay for use of additional storage or work areas if needed to perform the Work.

1.08 OWNER OCCUPANCY REQUIREMENTS

A. The existing water system serviced by the existing Edgell Road Water Pumping Station must remain in full service at all times, throughout the duration of the project. Contractor shall conduct his operations in accordance with Section 11280 – Maintaining Existing Flow.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

END OF SECTION

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SECTION 01015

SPECIAL CONDITIONS

1.01 BYPASS PIPING PLAN

A. The Contractor shall be required to submit a plan depicting the bypass pipe sizes, pump sizes, locations, proposed connections to existing water supply systems, and an associated sequence of operation associated with said plan. The bypass system shall be designed by a professional engineer and integrated with both the MWRA Telog Unit and the City's SCADA system.

B. The Engineer shall retain the right to request any additional information that he or she feels ensures the integrity of the existing system, and consequently, should be incorporated into the submittal.

C. The submittal shall be in the form of a shop drawing and no work may proceed without the approval of said shop drawing by the Engineer.

D. Refer to specification section 11280 – Maintaining Existing Flows for requirements.

1.02 DISRUPTION OF EXISTING WATER SUPPLY SYSTEM

A. The Contractor's attention is directed to the requirements of notifying residents affected by a disruption in water service of any kind including but not limited to shutting down of existing mains, and installation of temporary water bypass systems. The Contractor shall schedule shutdowns with the Engineer at least three days in advance to enable the Engineer to contact the affected homeowners and distribute notices a minimum of 48 hours prior to the disruption.

B. The Contractor will not be allowed to operate any hydrants or gate valves. The City will operate all City owned hydrants and gate valves. MWRA will operate all MWRA owned hydrant and gates.

END OF SECTION

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SECTION 01020

ALLOWANCES

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes

1. Allowances and their respective value which have been established in the BID as an estimated lump sum to facilitate comparison of bids only.

B. Related Sections

1. Section 01025 - Measurement and Payment

1.02 ALLOWANCES

A. Electric Service Allowance - Bid Item No. 2.

1. Allowance is specific to services provided by Eversource.
2. Provide the new electric service as shown on the Contract Drawings, required by the Eversource or as directed by the Engineer.
3. Coordinate all work with the respective utility company or department providing access to the site at the appropriate time to prevent any delay in the work specified to be done under these Contract Documents.

1.03 PAYMENT PROCEDURES

A. Under these items, the Contractor shall be reimbursed for charges for the allowances required and authorized by the Owner and Engineer, as detailed in Section 01025 - Measurement and Payment.

B. The lump-sum price for allowances is established in the Bid Forms as an estimated figure to facilitate comparison of bids only. The actual amount to be paid under this item shall constitute full compensation for services rendered.

C. The lump-sum price for this item shall NOT include any costs associated with services rendered for routine utility markings, repair damages incurred as a result of the Contractor's operations, relocations of utilities done at the Contractor's request and/or convenience, or any other unauthorized services rendered by utility companies. The purpose of this item is strictly for the Contractor's reimbursement for those services authorized by the Owner or Engineer prior to the work being performed.

D. The Contractor will be paid based on the actual PAID invoiced amount from the authority in question as approved by the Engineer. If the total cost for such charges is greater or less than the allowance amount stated under this item of the BID, a debit or credit of the difference in cost shall be to the Owner.

PART 2 PRODUCTS

2.01 MATERIALS

A. Materials as required and ordered by the Engineer shall conform to the Contract Documents.

PART 3 EXECUTION

3.01 INSTALLATION

A. Installation, relocation, or repair of utilities, shall be performed in accordance with the Contract Documents.

END OF SECTION

SECTION 01025

MEASUREMENT AND PAYMENT

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes

1. Measurement and payment criteria applicable to the Work performed under a unit price and/or lump sum payment method of Items listed in the BID.

B. RELATED SECTIONS

1. INVITATION FOR BIDS - Bid Package
3. Section 01020 - Allowances
4. Section 01026 - Schedule of Values

1.02 LUMP SUM PRICES

A. Payment will be computed on the basis of the percentage of work completed on each Item in the contract BID as determined by the Engineer. Lump sum prices are to include the cost of all necessary materials, labor, equipment, overhead, profit and other applicable costs. (See Par. 1.03, this Section.)

B. The Contractor's breakdown (submit under SECTION 01026) of the lump sum bid will be used only as a guide to determine the percentage of completion.

1.03 PRICES INCLUDE

A. The prices stated in the Proposal include full compensation not only for furnishing all the labor, equipment and material needed for, and for performing the work and building the structures contemplated by, the Contract, but also for assuming all risks of any kind for expenses arising by reason of the nature of the soil, ground water, or the action of the elements; for all excavation and backfilling; for the removal of and delay or damage occasioned by trees, stumps, tracks, pipes, ducts, timber, masonry or other obstacles; for removing, protecting, repairing, or restoring, without cost to the Owner, all pipes, ducts, drains, sewers, culverts, conduits, curbs, gutters, walks, fences, tracks, or other obstacles, road pavements and other ground surfacing whether shown on plans or not for draining, damming, pumping or otherwise handling and removing, without damage to the work or to other parties, and without needless nuisance, all water or sewage from whatever source which might affect the work or its progress, or be encountered in excavations made for the work; for maintaining uninterrupted water service and temporary pumping, for providing temporary equipment, systems and facilities as specified and as necessary; for furnishing, inserting and removing all sheeting, shoring, staging, cofferdams, etc.; for all signs, fencing, lighting, watching, guarding, temporary surfacing, bridging, snow removal, etc., necessary to maintain and protect travel on streets, walks and private ways; for making all provisions necessary to maintain and protect buildings, fences, poles,

trees, structures, pipes, ducts and other public or private property affected or endangered by the work; for the repair or replacement of such things if injured by neglect of such provisions for removing all surplus or rejected materials as may be directed; for replacing, repairing and maintaining the surfaces of streets, highways, public and private lands if and where disturbed by work performed under the Contract or by negligence in the performance of work under the Contract; for furnishing the requisite filling materials in case of any deficiency or lack of suitable materials; for obtaining all permits and licenses and complying with the requirements thereof, including the cost of furnishing any security needed in connection therewith; for any and all expense on account of the use of any patented device or process; for protection against inclement or cold weather; for all expenses incurred by or on account of the suspension; interruption or discontinuance of work; for the cost of the surety bond and adequate insurance; for all taxes, fees, union dues, etc., for which the Contractor may be or become liable, arising out of his operations incidental to the Contract; for providing equipment on the site and off site; for providing a field office and its appurtenances and for all general and incidental expenses; for tools, implements and equipment required to build and put into good working order all work contemplated by the Contract; for maintaining and guaranteeing the same as provided; and for fulfilling all obligations assumed by the Contractor under the Contract and its related documents.

B. The Owner shall pay and the Contractor shall receive the prices stipulated in the BID made a part hereof as full compensation for everything performed and for all risks and obligations undertaken by the Contractor under and as required by the Contract.

C. The prices for those Items which involve excavation shall include compensation for disposal of surplus excavated material and handling water.

1.04 PAYMENT

A. Refer to General Conditions: Article 14 – Payments to Contractor and Completion.

1.05 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

BID ITEM NO. 1 EDGELL ROAD WATER PUMPING STATION REPLACEMENT

A. The lump sum price for this Item shall constitute full compensation for furnishing all labor, materials, tools and equipment necessary, to reconstruct the Edgell Road Water Pumping Station, including but not limited to mobilization and demobilization; providing the Contractor's Health and Safety Plan; coordination with City officials, including phasing project to minimize disruption to the existing water system; providing all required portable generators, bypass piping, bypass pumps and controls; site preparation; erosion and sedimentation control; demolition; construction of a new pump station, protection and reuse of the existing foundation; underground electric duct banks; protection of all existing structures and utilities; remove and replace site paving; loaming and seeding; test pits to determine depth of existing utilities; all excavation; backfill; sub-grade preparation; the removal and disposal of existing equipment, including hazardous waste identified in Appendix A; temporary stockpiling of excess soil for testing by the City; cleaning the existing station of all

debris; piping, fittings, valves and connections to existing water lines; pipe supports; equipment pads; pumps; instrumentation and control equipment; startup; testing and training complete as shown on the Drawings and as specified herein.

B. Item shall also constitute compensation for protection of all existing structures and utilities, all concrete work, architectural, structural, mechanical, plumbing, electrical, instrumentation, and all associated appurtenant work, as indicated on the Drawings and as specified in the Bidding and Contract Requirements and Divisions 1 through 16, except for the requirements of Bid Item 2.

C. Payment of the lump sum bid in the Bid Form shall be full compensation for furnishing all labor, materials, equipment, and incidentals required, to perform the Work, in its entirety as shown on the Drawings as specified. Payment shall fully compensate the Contractor for any incidental work which is not specified or shown but which is evidently required to complete the work.

BID ITEM NO. 2 ELECTRIC SERVICE ALLOWANCE

A. The lump sum price to be paid for under this Item shall constitute full compensation as detailed in Section 01020 - Allowances, and not specifically paid for under other Items, as directed by the Engineer.
B. The lump sum price allowance for this Item established in the Bid is an estimated figure to facilitate comparison of bids only. The actual amount to be paid under this Item to the Contractor will be the amount invoiced by the electric company.
C. The lump sum price allowance for this Item shall NOT include any costs associated with Items and/or services for which specific payment Items are provided for under the Bid.
D. If the total cost for such charges is greater or less than the allowance amount stated under this Item of the Bid, a debit or credit of the difference in such cost shall be to the Owner.

BID ITEM NO. 3 SAXONVILLE PUMP STATION ROOF REPLACEMENT

A. The lump sum price for this Item shall constitute full compensation for furnishing all labor, materials, tools and equipment necessary, to replace the Saxonville Pump Station existing roof, including but not limited to mobilization and demobilization; providing the Contractor's Health and Safety Plan; coordination with City officials, including phasing project to minimize disruption to the existing station; demolition; construction of a new roof; the removal and disposal of existing materials, including hazardous waste identified in Appendix C; cleaning the existing station of all debris; rough carpentry; installing insulation, metal flashing, trim, joint sealants and thermoplastic single-ply roofing; coordination with existing roof penetrations; complete as shown on the Drawings and as specified herein.

B. Payment of the lump sum bid in the Bid Form shall be full compensation for furnishing all labor, materials, equipment, and incidentals required, to perform the Work, in its entirety as shown on the Drawings as specified. Payment shall fully compensate the Contractor for any incidental work which is not specified or shown but which is evidently required to complete the work.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

END OF SECTION

SECTION 01026

SCHEDULE OF VALUES

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes

1. Requirements for breakdown of lump sum bid.

B. Related Sections

1. Section 01300 - Submittals

1.02 BREAKDOWN OF LUMP SUM BID

A. Within 20 business days of the date of the executed Contract, a list detailing the breakdown of the lump sums bid by the appropriate Divisions of these Specifications or as otherwise directed by the Engineer, shall be submitted for review and concurrence by the Engineer. This list will be used by the Engineer as a guide in preparing estimates for payment. The list shall be an accurate representation of costs required to complete the Work in accordance with the Contract Documents.

B. A schedule of the monthly value of work done based on the Progress Schedule submitted under Section 01300 - Submittals shall be submitted within 20 business days of the date of the executed Contract. The schedule shall show the total sum of work done for each month of the projected construction period and shall be updated monthly to reflect the actual amount requisitioned for payment.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

END OF SECTION

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SECTION 01040

COORDINATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Requirements for coordinating the various parts of Work under this Contract.

1.02 REQUIREMENTS

A. Coordinate scheduling, submittals, and Work of the various Sections of specifications to assure efficient and orderly sequence of installation of interdependent construction elements.

B. 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.

C. Coordinate space requirements and installation of mechanical, instrumentation 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.

D. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.

E. Coordinate completion and clean up of Work of separate Sections in preparation for Substantial Completion.

F. Access to the temporary bypass pumping system and MWRA owned valves, vaults, etc., must be maintained throughout construction.

G. After Owner occupancy of premises following substantial completion, coordinate access to site for correction of defective Work and Work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

H. Coordinate work with all utility companies necessary for completion of work under this contract. MWRA requires a minimum of 2-weeks notification for valve or instrumentation crews. The OWNER/Engineer will coordinate with MWRA following a request by the Contractor.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

END OF SECTION

SECTION 01045

CUTTING, CORING AND PATCHING

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes

1. Requirements and limitations for cutting, coring and patching of Work.

B. Related Sections

1. Section 01300-Submittals

1.02 SUBMITTALS

A. In accordance with Section 01300 submit written request in advance of cutting or alteration which affects the following:

1. Structural integrity of any element of Project.
2. Integrity of weather-exposed or moisture-resistant element.
3. Efficiency, maintenance, or safety of any operational element.
4. Visual qualities of sight exposed elements.
5. Work of Owner or separate contractor.

B. Include in request:

1. Identification of Project.
2. Location and description of affected work.
3. Necessity for cutting or alteration.
4. Description of proposed work, and products to be used.
5. Alternatives to cutting and patching.
6. Effect on work of Owner or separate contractor.
7. Written permission of affected separate contractor.
8. Date and time work will be executed.

C. Should conditions of the Work, or schedule, indicate a required change of materials or methods for cutting and patching, notify the Engineer and secure his written permission and the required Change Order prior to proceeding.

1.03 RELATED SECTIONS

A. Section 15050 – Pipe Penetrations

PART 2 PRODUCTS

2.01 MATERIALS

A. For replacement of items removed, use materials complying with pertinent sections of these specifications.

B. Sealing materials to be used to seal annular space between cored hole in walls and related pipes to be in accordance with Section 15050.

C. Sealing cored holes in sewer manholes to be with a resilient seal similar to Kor-N-Seal made by National Pollution Control Systems, Inc., Nashua, NH or similar product, as indicated on the Drawings.

PART 3 EXECUTION

3.01 EXAMINATION

A. Site Verification of Conditions

1. Inspect existing conditions, including elements subject to movement or damage during cutting, excavating, patching, and backfilling.
2. After uncovering the work, inspect conditions affecting installation of new work.
3. If uncovered conditions are not as anticipated, immediately notify the Engineer.
4. Do not proceed until unsatisfactory conditions are corrected.

3.02 PREPARATION

A. Protection

1. Provide required protection including, but not necessarily limited to, shoring, bracing, and support to maintain structural integrity of the Work.
2. Perform cutting and demolition by methods which will prevent damage to portions of the Work.

B. Surface Preparation

1. Provide proper surfaces to receive installation of repair and new work.

3.03 INSTALLATION

A. Use adequate numbers of skilled workmen who are trained and experienced in the necessary crafts and who are familiar with the specified requirements and the methods needed for proper performance of the Work.

B. Execute cutting, fitting, and patching (including excavation and fill) to complete work.

C. Installation of materials shall be in accordance with manufacturer’s instructions.

D. Installations, repair or replacement of items provided under this Contract shall be in accordance with the Contract Documents.

3.04 FIELD QUALITY CONTROL

A. In addition to other requirements specified, upon the Engineer's request uncover work to provide for inspection by the Engineer of covered work, and remove samples of installed materials for testing.

B. Do not cut or alter work performed under separate contracts without the Engineer's written permission.

3.05 ADJUSTING

A. Perform fitting and adjusting of products to provide finished installation complying with the specified tolerances and finishes.

END OF SECTION

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SECTION 01050

FIELD ENGINEERING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Survey work and other field engineering responsibilities of the Contractor.

1.02 REQUIREMENTS

A. The Contractor shall be responsible for layout of the work and the establishing of lines and grades.

B. Establish elevations, lines, levels, reference marks, batter boards, etc., required during the progress of the Work. Verify such marks by instrument to confirm accuracy.

C. Locate and protect survey control and reference points.

D. Make, check, and be responsible for all measurements and dimensions necessary for the proper construction of the Work.

E. The Engineer will be permitted to check the lines, elevations, reference marks, batter boards, etc., set by the Contractor. The Contractor shall correct any errors found in lines, elevations, reference marks, batter boards, etc.. Such a check shall not be construed as approval of the Contractor's work and shall not relieve or diminish the responsibility of the Contractor for the accurate construction and completion of the Work.

F. Control datum for survey as shown on Drawings.

1.03 QUALITY ASSURANCE

A. Qualifications

B. Qualifications

1. Employ a Civil Engineer or Land Surveyor registered within the Commonwealth of Massachusetts, acceptable to the Engineer.

C. Certifications

1. Submit certificate signed by the Contractor’s Engineer or Land Surveyor stating elevations and locations of the Work are in conformance with the Contract Documents.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

END OF SECTION

SECTION 01060

REGULATORY REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Building codes, Mechanical codes, and Electrical codes, Regulations, Permits and Fees applicable to the project.

1.02 PERMITS BY CONTRACTOR

A. The Contractor shall secure all necessary permits from the state, city or town authorities having jurisdiction, for digging of trenches in the streets or highways and all other building and construction operations requiring permits.

B. As a minimum the following permits are required:

1. Demolition Permit – City of Framingham
2. Building Permit – City of Framingham
3. Electrical Permit – City of Framingham
4. Plumbing Permit – City of Framingham
5. Gas Permit – City of Framingham
6. Sheet Metal Permit – City of Framingham
7. Above Ground Storage Tank Removal Permit – Framingham Fire Department
8. National Pollutant Discharge Elimination System (NPDES) General Permit for Discharge Construction Activities, Includes Stormwater Pollution Prevention Plan. (SWPPP).
9. Sewage Disposal System Abandonment Application – City of Framingham, Department of Public Health (Attachment 1)
10. Excavation and Trench Safety Permit in accordance with M.G.L. c. 82A, and 520 CMR 14.00. – City of Framingham, Dept. of Public Works

1.03 PERMITS BY OWNER

A. The Owner has obtained or will obtain and pay all fees for the permits listed here:

1. Order of Conditions – Local Conservation Commission
2. MADEP – BRP WS 32 – Distribution System Modification of Public Water Supply System of More than 3,300 People
3. MWRA – 8M Permit

1.04 CODES

A. The Contractor shall conform to the requirements of and pay all fees imposed by local and State Building Authorities having jurisdiction over the Work. The Contractor is responsible to conform to all building, mechanical, electrical and plumbing code requirements.

B. The Contractor shall conform to the latest requirements of the following codes:

1. Federal, State and Municipal Laws
2. Commonwealth of Massachusetts State Building Code, 780 CMR
3. Commonwealth of Massachusetts State Plumbing Code 248 CMR 10.00
4. Commonwealth of Massachusetts Electrical Code 527 CMR 12.00
5. Any prevailing rules and regulations pertaining to adequate protection and/or guarding of any moving parts or otherwise hazardous locations.

1.04 FEES

A. The cost of all permits secured by the Contractor shall be borne by him and shall be considered as having been included in the price or prices stated in the Bid. Copies of all required permits shall be filed with the Engineer prior to starting work for which a permit is required.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

END OF SECTION

Attachment 1

Sewage Disposal System Abandonment Application

FRAMINGHAM
MASSACHUSETTS

City of Framingham
Department of Public Health

Public Health
Prevent. Promote. Protect.

Mailing Address: 150 Concord Street Room 205, Framingham, MA 01702
Framinghamma.gov

Office Telephone: (508) 532-5470
Office Fax: (508) 532-5760
Office Email: health@framinghamma.gov

Sewage Disposal System Abandonment Application

Complete the application below to abandon an existing sewage disposal system.

Date: _____

Owner's Information

Name of Property Owner: _____

Address: _____

Phone Number: _____ Email: _____

Sewage Disposal System Location

Address where the sewage disposal system is located: ☐ Check if address is the same as above _____

_____

Installer / Contractor Information

Name of Installer / Contractor: _____

Address: _____

Phone Number: _____ Email: _____

Reason for the Abandonment:

☐ Connect to Municipal Sanitary Sewer ☐ Construct a **NEW** onsite individual sewage disposal system

☐ Other – Specify: _____

_____

If the above listed property (where the sewage disposal system is to be abandoned) is being connected to a private or municipal sanitary sewer system, **a copy of the sewer connection must be submitted with this application.**

The following steps are required in order to properly abandon the existing sewage disposal system:

1. The septic tank shall be pumped of its entire contents by a licensed septic / sewage hauler.
2. The tank shall be excavated and removed from the site.
3. The bottom of the tank shall be opened or ruptured after being pumped of its contents to prevent retainage of water.
4. The tank shall be completely filled with clean sand, common fill or other suitable material approved in writing by the Board of Health.

Proper abandonment of the septic tank or cesspool must be witnessed by the Framingham Department of Public Health. Please provide at least two days (48 hours) advance notice. Once the abandonment has been witness, further use of the system for any purpose is prohibited and a Certificate of Sewage Disposal System Abandonment will be issued.

Proposed Date of Scheduled Abandonment: _____ Time: _____

Signature: _____ Print: _____

Submit the following:

☐ Completed Septic System Abandonment Application.

☐ **Fee of $25.00** made payable to the "City of Framingham". At this time, credit cards are not accepted. All fees are non-refundable.

☐ A copy of the septic / sewage hauler pump report for the above sewage system disposal abandonment.

For Official Use Only

Name of Inspector: _____ Signature: _____

Date Abandonment was witnessed: _____ Time: _____

Date Certificate of Septic Abandonment was issued: _____

Additional Notes: _____

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SECTION 01069

HEALTH & SAFETY REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Requirements for providing a Health and Safety Plan (HASP) and maintenance of health and safety while performing the Work.

1.02 REQUIREMENTS

A. Monitor working conditions at all times during construction and provide appropriate protective clothing, equipment and facilities for personnel, and establish workplace procedures to ensure personnel safety.

B. Implement a Health and Safety protection program. The procedures for such implementation shall be submitted to the Engineer and Owner for approval. The procedures shall include provisions for stations allowing workers to wash and to put on and remove protective clothing, and stations for vehicles to be cleaned, if necessary, before leaving the site, air monitoring, and evaluation of areas where unsafe levels of gas has accumulated.

C. Comply with all Federal, State, and local safety requirements related to the hazards anticipated to be encountered during the course of this project.

D. In addition to the above requirements, comply with the following:

1. All construction equipment on the site shall be equipped with vertical exhaust pipes or a spark proof exhaust.
2. Smoking shall not be permitted in any area where gases can accumulate, within the site building or in areas where contaminated soil is present.
3. Welding or open flames shall not be permitted in enclosed areas.
4. Toxic gas indicators, an organic vapor analyzer, a combustible gas indicator, an oxygen indicator, and fire extinguishers shall be available at all times during operations. Periodic monitoring with portable monitoring devices shall be employed as dictated by the Health and Safety Plan.
5. During operations, whenever unsafe levels of toxic gases are detected, all work will cease in that area until acceptable levels are reached.

1.03 SHOP DRAWINGS

A. Submit site specific Health and Safety Plan (HASP) that complies with all applicable OSHA requirements to the Engineer for review and acceptance within fifteen (15) working days of the Contractor's Notice to Proceed. Certified Industrial Hygienist must certify the Contractor's plan prior to submittal to and review by the Engineer. The Contractor is not to proceed with any subsurface or site work without review and acceptance of the submitted Health and Safety Plan by the Engineer.

1.04 QUALITY ASSURANCE

A. Engage an independent, qualified Health and Safety expert having experience in similar construction conditions, to monitor site conditions and recommend all necessary Health and Safety protection. This person shall be a Certified Industrial Hygienist (CIH). The Contractor shall follow such recommendations and shall provide such protection to his personnel, and personnel of the Owner and Engineer, as may be affected.

1.05 REGULATORY REQUIREMENTS

A. Establish work place procedures, enforce the use of these procedures, and the associated equipment and facilities in accordance with the following guidelines:

1. Safety and Health Regulations Promulgated by the U.S. Department of Labor OSHA, 29 CFR 1910 - Occupational Safety and Health Standards, and 29 CFR 1920 - Safety and Health Regulations for Construction.
2. Occupational Safety and Health Standards, 29 CFR 1926 - Safety and Health Regulations for Construction.
3. U.S. Environmental Protection Agency Medical Monitoring Program Guidelines.

1.06 SITE CONDITIONS

A. The Contractor's attention is directed to the fact that the work includes connecting new pipe lines to the existing sewer and water systems. In addition to confined space issues, hazardous gasses and oxygen depletion may be encountered in the existing sewer system where proposed work is to take place.

B. The Contractor is also responsible for reviewing site specific investigation reports included in the Appendix of these specifications.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

3.01 PROTECTION

A. If, at any time, the Owner or the Engineer is apprised of a safety hazard which demands immediate attention because of its high potential for harm to the public travel, persons on or about the Work, or public or private property, the Owner or the Engineer shall have the right to order such safeguards to be erected and such precautions to be taken as necessary and the Contractor shall comply with such orders. If, under such circumstances, the Contractor does not or cannot immediately put the Work into proper and approved condition, or if the Contractor or his representative is not upon the site so that he can be notified immediately of the

insufficiency of safety precautions, then the Owner may put the Work into such a condition that is, in his opinion, in all respects safe, and the Contractor shall pay all expenses of such labor and materials as may have been used for this purpose by him or by the Owner. The fact that the Owner or the Engineer does not observe a safety hazard or does not order the Contractor to take remedial measures shall in no way relieve the Contractor of the entire responsibility for any costs, loss or damage by any party sustained on account of the insufficiency of the safety precautions taken by him or by the Owner acting under authority of this Section.

B. If the Contractor is alerted to the fact that conditions of high hazard are present or can be present at the site during the performance of the Work, it is the responsibility of the Contractor to take appropriate safety precautions to meet whatever conditions of hazard may be present during the performance of the Work, whether reasonably foreseeable or not. The safety conditions enumerated in the Specifications are the minimum permissible and neither the Owner not the Engineer makes any representation that the safety standards provided herein will be adequate to meet all eventualities. The Contractor is therefore alerted to the fact that it shall be his responsibility to anticipate and provide such additional safety precautions, facilities, personnel and equipment as shall be necessary to protect life and property from whatsoever conditions of hazard are present or may be present.

END OF SECTION

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SECTION 01090

REFERENCE STANDARDS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Reference material, abbreviations, and terms used in the Construction Documents and establishes edition dates and complete titles for standards referenced elsewhere in the Specifications.

1.02 QUALITY ASSURANCE

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. Obtain copies of standards when required by Contract Documents.

C. Maintain copy at jobsite during submittals, planning, and progress of the specific work, until Substantial Completion.

D. Should specified reference standards conflict with Contract Documents, request clarification from Architect/Engineer before proceeding.

E. The contractual relationship of the parties to the Contract shall not be altered from the Contract Documents by mention or inference otherwise in any reference document.

1.03 SCHEDULE OF REFERENCES

AA	Aluminum Association 1400 Crystal Dr. Suite 430 Arlington, VA 22202
AASHTO	American Association of State Highway and Transportation Officials 444 North Capitol Street, N.W. Washington, DC 20001
ACI	American Concrete Institute 38800 Country Club Dr. Farmington Hills, MI 48331-3439
AFBMA	Anti-Friction Bearing Manufacturers Association 2025 M. Street, NW Washington, DC 20036-3309

AGC	Associated General Contractors of America 2300 Wilson Blvd. Arlington, VA 22201
AGM	American Gear Manufacturers Association 1001 N. Fairfax Street Alexandria, VA 22314-1587
AI	Asphalt Institute 2696 Research Park Drive Lexington, KY 40511-8480
AISC	American Institute of Steel Construction One East Wacker Drive Chicago, IL 60601-1802
AISI	American Iron and Steel Institute 25 Massachusetts Drive Washington, DC 20001
AMCA	Air Movement and Control Association 30 West University Drive Arlington Heights, IL 60004
ANS	American National Standard
ANSI	American National Standards Institute 1899 L Street, NW, 11th Floor Washington, DC 20036
API	American Petroleum Institute 1220 L Street, NW Washington, DC 20005
ARI	Air-Conditioning and Refrigeration Institute 2111 Wilson Boulevard Arlington, VA 22201
ASCE	American Society of Civil Engineers 1801 Alexander Bell Drive Reston, VA 20191
ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Engineers 1791 Tullie Circle, N.E. Atlanta, GA 30329

ASME	American Society of Mechanical Engineers Two Park Avenue New York, NY 10016-5990
ASPA	American Sod Producers Association 1855 A Hicks Road Rolling Meadows. IL 60008
ASTM	American Society for Testing and Materials 100 Bar Harbor Drive PO Box C700 West Conshohocken, PA 19428-2959
AWG	American or Brown and Sharpe Wire Gage
AWPA	American Wood-Preservers' Association 100 Chase Park South Birmingham, AL 35244-1851
AWS	American Welding Society
AWWA	American Water Works Association 6666 West Quincy Avenue Denver, CO 80235
BIA	Brick Institute of America 1850 Centennial Park Drive Reston, VA 20191
CS	Commercial Standard
EJCDC	Engineers' Joint Contract Document Committee American Consulting Engineers Council 1015 15th Street, N.W. Washington, DC 20005
FM	Factory Mutual System 1151 Boston-Providence Turnpike PO Box 688 Norwood, Massachusetts 02062
Fed Spec.	Federal Specification General Services Administration Specification and Consumer Information Distribution Section (WFSIS) Washington Navy Yard, Bldg. 197 Washington, DC 20407

HMA	Hot Mix Asphalt
IBR	Institute of Boiler and Radiator Manufacturers
ICBO	International Conference of Building Officials 900 Montclair Road Birmingham, AL 35213-2298
IPS	Iron Pipe Size
JIC	Joint Industry Conference Standards
MIL	Military Specification Naval Publications and Forms Center 5801 Tabor Avenue Philadelphia, PA 19120
NASSCO	National Association of Sewer Service Companies 2470 Longstone Lane Marriottsville, MD 21104
NBS	National Bureau of Standards
NCMA	National Concrete Masonry Association 13750 Sunrise Valley Drive Herndon, VA 20171
NCPWB	National Certified Pipe Welding Bureau
NEMA	National Electrical Manufacturers' Association 1300 North 17th Street Arlington, VA 22209
NFPA	National Fire Protection Association Battery March Park Quincy, MA 02269
NPT	National Pipe Thread
OS&Y	Outside screw and yoke
PCA	Portland Cement Association 5420 Old Orchard Road Skokie, IL 60077
SMACNA	Sheet Metal and Air Conditioning Contractors' National Assoc.

	4201 Lafayette Center Drive Chantilly, VA 20151-1219
Stl. WG	U.S. Steel Wire Washburn and Moen, American Steel and Wire or Roebling Gage
UL	Underwriters' Laboratories, Inc. 333 Pfingston Road Northbrook, IL 60062
USS Gage	United States Standard Gage
125-lb. ANS 250-lb. ANS	American National Standard for Cast-Iron Pipe Flanges and Flange Fittings, Designation B16.1-1975, for the appropriate class

1.04 EDITION DATES

A. Reference to publications and reference material shall be understood to mean the latest edition, unless stated otherwise.

PART 2 PRODUCTS NOT USED

PART 3 EXECUTION NOT USED

END OF SECTION

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SECTION 01200

PROJECT MEETINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Administrative and procedural requirements for project meetings.

1.02 PRECONSTRUCTION CONFERENCE

A. The Engineer will schedule and administer a kick-off and pre-construction conferences according to Article 2 of the Standard General Conditions.

1.03 PROGRESS MEETINGS

A. The Engineer will schedule and administer progress meetings and specially called meetings throughout the duration of the Work at minimum weekly intervals.

B. The time and location of such meetings shall be designated by the Engineer and shall be convenient for all parties involved.

C. The Engineer will prepare agenda with copies for participants, preside at meetings, record minutes, and distribute copies to participants, and those affected by decisions made.

1.04 PRE-INSTALLATION MEETINGS

A. The Contractor will schedule pre-installation meetings for the following specification sections:

1. 04210 Architectural Face Brick,
2. 04230 Placement of Reinforced Concrete Masonry
3. 07270 Air Barriers
4. 07454 Roofing Installation and Associated Work
5. 07620 Sheet Metal Flashing and Trim
6. 07841 Penetration Firestopping
7. 08511 Steel Windows
8. 09761 Resinous Flooring

B. The Contractor shall provide a minimum of two weeks notice prior to scheduling a pre-installation meeting.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

END OF SECTION

SECTION 01300

SUBMITTALS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Requirements for submission of schedules and shop drawings.

1.02 PROGRESS SCHEDULE

A. Refer to Section 01310 Construction Progress Schedule for Critical Path Method (CPM) construction scheduling requirements.

B. Special attention is directed to the requirement that the Contractor shall start the Work, as specified under this Contract, no later than thirty (30) calendar days after the execution of the Contract Documents, unless otherwise directed by the Owner. The Contractor shall comply with all pre-construction requirements as specified. The Owner reserves the right to delay the commencement of the Work or any part thereof if the specified requirements as determined by the Engineer have not been satisfied. The Owner further reserves the right to limit or, delay construction, or certain activities thereof, in certain areas of the Contract should the Owner deem it to be in the public's best interest and/or safety to do so.

C. The Contractor shall contact the appropriate City authorities concerning any public or semi-public events that may occur during the construction period that may affect construction. The Contractor alone shall be responsible for arranging his construction sequence to conform to any restrictions these events may impose. No claims for extras will be allowed because of any delay, extra materials handling, extra excavation, etc. caused by the imposed restrictions. However, additional time may be granted for completion of the work to compensate for delays caused by said restrictions.

1.03 SHOP DRAWINGS

A. Submit one (1) electronic copy through the Project’s online file sharing system of all shop and working drawings for the Contract, and materials and equipment for which such drawings are specifically requested.

B. A maximum of two (2) submittals of each shop drawing will be reviewed by the Engineer. If more submittals are required due to the Contractor’s neglect or failure to fulfill the requirements of the Contract plans and specifications, or to make corrections or modifications required by the Engineer in the review of the first two submittals, the Engineer will review the submittal and the Contractor will be responsible for the cost of the review, as determined by the Owner based on the

Engineer's documentation of time and rates for additional services established in the Engineering Agreement between the Owner and the Engineer.

C. If resubmittals are required by the Engineer, one (1) electronic copy of the complete submittal shall again be submitted through the Projects online file sharing system.

D. Such drawings shall show the principal dimensions, weight, structural and operating features, space required, clearances, type and/or brand of finish or shop coat, etc., depending on the subject of the drawing. When the dimensions are of particular importance, or when specified, the drawings shall be certified by the manufacturer or fabricator as correct for the Contract.

E. When so specified or if considered by the Engineer to be acceptable, manufacturer's specifications, catalog data, descriptive matter, illustrations, etc., may be submitted in place of shop and working drawings.

F. The Contractor shall be responsible for the prompt and timely submittal of all shop and working drawings to eliminate delay to the Work due to the absence of such drawings. All shop and working drawings must be submitted to the Engineer within thirty (30) calendar days prior to incorporation into the Work, unless otherwise permitted by the Engineer. **Prior to the submittal of any shop drawings, the Contractor shall submit a schedule of proposed shop drawing transmittals.** The schedule shall identify the subject matter of each transmittal, the corresponding specification section number and the proposed date of submission. Prior to and during the progress of the Work the schedule shall be revised and resubmitted as requested by the Engineer.

G. The Contractor shall submit for review and acceptance the following submittals / plans prior to the start of any construction activity. No work will be allowed to commence without the submission and acceptance of the submittals unless authorized in writing by the Engineer.

1. Project Emergency Contact List
2. EPA NPDES Construction General Permit (CGP) Notice of Intent (NOI) submission confirmation
3. Stormwater Pollution Prevention Plan (SWPPP) (CGP requirement; Appendix C)
4. Health and Safety Plan (Section 01069)
5. Soil & Waste Management Plan (Section 02080)
6. Asbestos Abatement Work Plan (Section 02082)
7. Lead Based Paint Removal and Off-Site Management Work Plan (Section 02090)
8. Dewatering Plan (Section 02140)
9. Water Disinfection, Sampling, and Dechlorination Plan (Section 02675)
10. Maintaining Existing Flow (Section 11280)

H. No material or equipment shall be purchased or fabricated for the Contract until the required shop and working drawings have been submitted as hereinabove provided and reviewed for conformance to the Contract requirements. All such materials and equipment and the work involved in their installation or incorporation into the Work shall then be as shown in and represented by said drawings.

I. Until the necessary review has been made, the Contractor shall not proceed with any portion of the Work for which review is required.

J. All shop and working drawings shall be submitted to the Engineer by and/or through the Contractor, who shall be responsible for obtaining shop and working drawings from his subcontractors and returning reviewed drawings to them. All shop and working drawings shall be prepared on standard size, 24-inch by 36-inch sheets, except those which are made by changing existing standard shop and working drawings. All drawings shall be clearly marked with the names of the Owner, Contractor, and building, equipment, or structure to which the drawing applies, and shall be suitably numbered. Submitted shop drawings shall be accompanied by a letter of transmittal, completed by the Contractor as approved by the Engineer. Shop Drawings shall be numbered sequentially 1, 2, 3, etc. Resubmitalls shall be identified by the original submittal number with and A, B, C, etc. (e.g. 1, 1A, 1B).

K. Only drawings which have been checked and corrected by the fabricator should be submitted to the Contractor by his subcontractors and vendors. Prior to submitting drawings to the Engineer, the Contractor shall check thoroughly all such drawings to satisfy himself that the subject matter thereof conforms to the Drawings and Specifications in all respects. All drawings which are correct shall be marked with the date, checker's name, and indication of the Contractor's approval, and then shall be submitted to the Engineer; other drawings shall be returned for correction.

L. If a shop drawing shows any deviation from the Contract requirements, the Contractor shall make specific mention of the deviations in his letter of transmittal.

M. The review of shop and working drawings by the Engineer will be general only, and nothing contained in this Section shall relieve, diminish or alter in any respect the responsibilities of the Contractor under the Contract Documents and in particular, the specific responsibility of the Contractor for details of design and dimensions necessary for proper fitting and construction of the work as required by the Contract and for achieving the result and performance as specified. The Contractor shall be responsible for errors and omissions in shop drawings.

N. Should the Contractor submit equipment that requires modifications to the structures, piping, electrical conduit, wires, appurtenances, or layouts etc., either existing or as detailed on the Drawings, he shall also submit details of the proposed modifications. If such equipment and modifications are accepted, the Contractor, at no additional cost to the Owner, shall do the work necessary to make such modifications.

O. The Contractor shall furnish additional copies of shop drawings or catalog cuts when so requested.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

END OF SECTION

SECTION 01310

CONSTRUCTION PROGRESS SCHEDULE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Requirements for computer generated Critical Path Method (CPM) construction scheduling and Narrative progress report.

B. No portion of this specification shall take precedent over the Contract Agreement.

1.02 SUBMITTALS

A. Submit in accordance with SECTION 01300-Submittals

1. Quality Assurance/Control Submittal
   a. Name and version of CPM software proposed for use.
   b. List of construction projects completed on which progress of work was controlled with CPM software.
2. Schedule
   a. Within **14 days** following the receipt of the Notice to Proceed, the Contractor shall submit **two** color copies of a computer generated schedule and a list of activities to the Engineer. Following review by the Engineer and Owner the Contractor shall meet with the Engineer and Owner to discuss the review. The Contractor shall incorporate the Engineer's comments into the schedule and submit eight color copies of the revised schedule within 14 days following receipt of the Engineer's comments.

B. Submit updated Construction Progress Schedule with each Pay Request.

PART 2 PRODUCTS

2.01 SOFTWARE

A. Computer based scheduling software used by the Contractor shall be Microsoft Project.

PART 3 EXECUTION

3.01 PREPARATION

A. General

1. The Contractor shall prepare his proposed CPM schedule based on a breakdown of work tasks and Schedule of Values that he has developed.
2. The construction schedule and updates shall be prepared by the Contractor or the Contractor's qualified consultant.

B. Schedule

1. Each schedule shall be prefaced with the following summary data:
   a. Contract name and number
   b. Contractor's Name
   c. Contract duration
   d. The effective or starting date of the schedule
   e. Revision date of the latest schedule.
2. The CPM schedule shall be sequenced by early start date and shall include the following minimum items:
   a. Activity Name
   b. Estimated duration
   c. Activity description
   d. Early start date (calendar date)
   e. Early finish date (calendar date)
   f. Latest allowable start date (calendar date)
   g. Latest allowable finish date (calendar date)
   h. Status (whether critical)
   i. Estimated cost of the activity
   j. Float (total and free)
   k. Major milestones
3. Separate milestones shall be included for Notice-to-Proceed and Project Completion Date.
4. Activities shall include major components of the work including submittals that might impact the critical path, subcontractor work, major and critical equipment design, fabrication, testing, delivery and installation times, system/subsystem/component testing, process and facility startup, training, demobilization, project cleanup and closeout. Critical portions of process instrumentation and control system work, shall be defined in detail in a sub schedule.
5. The sum of the costs assigned to the activities shall be equal to the Contract price. Activity costs shall not be assigned to submittals or submittal reviews. Comply with SECTION 01026-Schedule of Values. Provide a table showing the anticipated monthly percentage of completion, based on the total contract price.
6. Critical activities, predecessors, free float and total float shall be clearly displayed on the schedule in graphical form. Schedules that contain activities showing negative float or that extend beyond the contract completion date will not be approved.
7. Each schedule submittal shall also include a list of activities in the order in which the activities will be performed, along with activity durations, activity predecessors, type of predecessor (finish-start, finish-finish, start-start, lead/lag), and any dependency or required date.

8. The schedule shall be based on a standard 5-day work week with allowance for holidays and adverse weather.
9. Engineer's approval of the CPM schedule is advisory only and shall not relieve the Contractor of responsibility for accomplishing the work prior to the contract completion date. Omissions and errors in the approved CPM schedule shall not excuse performance less than that required by the Contract. Approval by the Engineer in no way makes the Engineer an insurer of the CPM schedule's success or liable for time or cost overruns flowing from its shortcomings. The Owner hereby disclaims any obligation or liability by reason of approval by its agent, the Engineer, of the CPM schedule.

C. Narrative Progress Report

1. Include as a minimum:
   a. Summary of work completed during the previous period (since submission of last narrative progress report).
   b. Explanation for variations between actual work completed in previous period and planned work as reported in last period.
   c. Summary of work planned during the next period.
   d. Current and anticipated delaying factors and their estimated impacts on other activities and milestones, both critical and non-critical.
   e. Corrective actions taken or proposed.
2. A Narrative Progress Report shall be submitted monthly to the Engineer with their Applications for Payment.
3. At the discretion of the Engineer, the Contractor may be required to submit a revised CPM schedule showing completion to date and any changes to the previous schedule.

3.02 MONITORING SCHEDULE

A. The CPM approved construction schedule shall be used by the Contractor throughout the duration of the project for planning, organizing, and directing the Work, and for reporting progress of the Work

B. The Contractor is solely responsible for monitoring schedule compliance. When a delay to the critical path occurs, the Contractor shall immediately notify the Engineer in writing. Within one week of the notification, the Contractor shall submit for the Engineer's approval, a description of proposed actions to return the project to schedule.

3.03 MODIFYING SCHEDULE

A. If the Contractor desires to make changes in his method of operating which affect the approved CPM schedule, he shall notify the Engineer in writing stating what changes are proposed and the reason for the change. If the Engineer approves these changes, the Contractor shall revise and submit for approval, without additional cost to the Owner, all of the affected portions of the CPM schedule.

B. It may be necessary for the contract schedule or completion time to be adjusted by the Owner to reflect the effects of job conditions, weather, technical difficulties, strikes, unavoidable delays on the part of the Owner or its representatives and other unforeseeable conditions which may indicate schedule adjustments or completion time extensions. Under such conditions, the Engineer will direct the Contractor to reschedule the work or contract completion time to reflect the changed conditions and the Contractor shall revise his schedule accordingly.

C. Float time is a project resource available to both the Contractor and the Owner to meet contract milestones and completion dates. Use of float suppression techniques such as preferential sequencing or logic, special lead/lag logic restraints, and extended activity times are prohibited, and use of float time disclosed or implied by use of alternate float suppression techniques shall be shared to proportionate benefit of OWNER and CONTRACTOR.

D. If the Contractor provides an accepted schedule with an early completion date, the Owner reserves the right to reduce the Time of Completion to match the early completion date by issuing a deductive Change Order at no change in Contract Price.

END OF SECTION

SECTION 01400

QUALITY CONTROL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Requirements for Contractor’s quality control of products, suppliers, manufacturers, services, site conditions, and workmanship, to produce Work of specified quality.

1.02 QUALITY ASSURANCE/CONTROL OF INSTALLATION

A. Comply fully with manufacturers' instructions, including each step in sequence.

B. Should manufacturers' instructions conflict with Contract Documents, request clarification from Engineer before proceeding.

C. Comply with specified standards as a minimum quality for the Work except when more stringent tolerances, codes, or specified requirements indicate higher 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.

1.03 FIELD SAMPLES

A. Install field samples at the site as required by individual specifications sections for review.

B. Acceptable samples represent a quality level for the Work.

C. Where field sample is specified to be removed, clear area only after field sample has been accepted by the Engineer.

1.04 CERTIFIED WELDERS

A. Structural welds shall be made only by operators who have been qualified by tests, as prescribed in the "Standard Qualification Procedure" of the American Welders Society, to perform the type of work required.

B. Pipe welds shall be made only by operators who have been qualified by the National Certified Pipe Welding Bureau and each operator's qualification record shall be submitted to the Engineer before any work is performed.

C. Shop welding shall be in accordance with the "Code for Welding in Building Construction".

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

END OF SECTION

SECTION 01410

TESTING LABORATORY SERVICES

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes

1. Qualification, duties and responsibilities of testing laboratories.
2. Coordination and scheduling responsibilities of the Contractor.

B. Related Sections

1. Section 01600 - Materials and Equipment

1.02 PAYMENT PROCEDURES

A. Initial Testing

1. The Owner will pay for initial testing services required by the Engineer, unless noted otherwise.

B. Retesting

1. When initial tests indicate noncompliance with the Contract Documents, subsequent retesting occasioned by the noncompliance shall be performed by the same testing agency, and costs thereof will be deducted by the Owner from the Contract Sum or paid directly by the Contractor.

C. Contractors Convenience Testing

1. Inspecting and testing performed exclusively for the Contractor's convenience shall be the sole responsibility of the Contractor.

1.03 REFERENCES

A. American Society for Testing and Materials (ASTM)

1. E329, Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection

1.04 REQUIREMENTS

A. Work included:

1. Cooperate with the Owner's Representative and all others responsible or testing and inspecting the Work.
2. Provide other testing and inspecting as specified to be furnished by the Contractor in this Section and/or elsewhere in the Contract Documents.
3. Where no testing requirements are described, but the Owner directs testing, the Contractor shall provide testing under the requirements of this Specification.

1.05 QUALITY ASSURANCE

A. Qualifications

1. The testing laboratory will be qualified to the Owner's approval in accordance with ASTM E329.

B. Regulatory requirements

1. Testing, when required, will be in accordance with all pertinent codes and regulations and with selected standards of the American Society for Testing and Materials.
2. Regulatory Requirements Inspections and tests required by codes or ordinances, or by a plan approved authority, and which are made by a legally constituted authority, shall be the responsibility of and shall be paid for by the Contractor, unless otherwise provided in the Contract Documents.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Comply with pertinent provisions of Section 01600 - Materials and Equipment.

B. Promptly process and distribute, to the Engineer, required copies of test reports and instructions to assure necessary retesting and replacement of materials with the least possible delay in progress of the Work.

1.07 SCHEDULING

A. Establishing schedule

1. By advance discussion with the testing laboratory selected by the Owner, determine the time required for the laboratory to perform its tests and to issue each of its findings.
2. Provide all required time within the construction schedule.
3. Coordinate testing activity with the appropriate testing laboratory.

B. Revising schedule

1. When changes of construction schedule are necessary during construction, coordinate all such changes with the testing laboratory as required.

C. Adherence to schedule

1. When the testing laboratory is ready to test according to the established schedule, but is prevented from testing or taking specimens due to incompleteness of the Work, all extra charges for testing attributable to the delay may be back-charged to the Contractor and shall not be borne by the Owner.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

3.01 FIELD QUALITY CONTROL

A. Site Tests

1. Representatives of the testing laboratory shall have access to the Work at all times and at all locations where the Work is in progress. Provide facilities for such access to enable the laboratory to perform its functions properly.
2. All specimens and samples for testing, unless otherwise provided in the Contract Documents, shall be taken by the testing personnel. All sampling equipment and personnel will be provided by the testing laboratory. All deliveries of specimens and samples to the testing laboratory will be performed by the testing laboratory.

END OF SECTION

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SECTION 01510

TEMPORARY UTILITIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Requirements for temporary utilities required during construction.

1.02 GENERAL REQUIREMENTS

A. The Contractor is responsible for payment of all costs associated with the installation and operation of all temporary utilities necessary for the completion of the work. The Contractor shall arrange with the Engineer and Owner methods of determining monthly utility costs for Temporary Utilities prior to connection of any temporary systems. The Contractor shall pay the Owner on a monthly basis for all temporary utility costs. The Temporary Utilities to be paid by the Contractor include but are not limited to the following: Electricity, Water, Sanitary, Heating, Ventilation, Plumbing and other services required to complete the work.

1.03 TEMPORARY WATER

A. Temporary pipe lines and connections from the permanent service lines, necessary for the use of the Contractor shall be installed, protected, and maintained at the expense of the Contractor.

B. Provide an adequate supply of drinking water from an approved source of acceptable quality, satisfactorily cooled, for his employees and those of his Subcontractors.

1.04 TEMPORARY ELECTRICITY

A. Provide electrical energy required for temporary lighting and power.

B. Assume all costs necessary to provide a temporary, separately metered electric service for all construction.

C. The Contractor shall pay for the cost of electrical energy consumed by himself.

D. Temporary wiring of a special nature shall be paid for by the Contractor including but not limited to special circuits required by electric welders, elevators, lifts, pumps or other special equipment requiring high-amperage and/or special voltage service and exterior lighting circuits for protection against vandalism, public warning lights and lights for advertising, etc.

E. The Contractor shall furnish all extension cords, sockets, motors, and accessories required for their work. They shall also pay for all temporary wiring of construction offices and buildings used by them.

F. Temporary wiring installed by the Contractor shall be removed after it has served its purpose.

G. Electrical work to be done in accordance with applicable codes.

1.05 TEMPORARY SANITARY FACILITIES

A. Provide adequate sanitary facilities for the use of those employed on the Work. Sanitary facilities shall be made available when the first employees arrive on the site of the Work, be properly secluded from public observation, and be maintained during the progress of the Work in suitable numbers.

B. Maintain sanitary facilities in an orderly and sanitary condition at all times and enforce their use. Rigorously prohibit the committing of nuisances on the site of the Work, on the lands of the Owner, or any adjacent property.

1.06 TEMPORARY HEATING

A. Within 30 calendar days after the execution of this Contract, submit in writing to the Engineer for approval, three copies of method and time schedule for heating during construction which shall concur with his progress schedule submitted under Specification Section 01300.

B. The installation and operation of heating devices shall comply with all safety regulations including provisions for adequate ventilation and fire protection. Heating devices which may cause damage to finish surfaces shall not be used.

C. After the permanent heating system has been installed, tested, and made ready for operation, the Contractor may, at his own risk and expense, use it for providing heat for protection of the Work. He shall provide and pay for all fuel and care necessary, and, when the Work is ready for acceptance, he shall, at his own expense, put the system into first-class condition, even to the extent of replacing worn or damaged parts as directed.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

END OF SECTION

SECTION 01525

TEMPORARY ENCLOSURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Requirements for protecting portions of the Work which are affected by inclement weather conditions.

B. Provide “Weather Protection” and heat to permit construction work to be carried on during the months of November through March. These Specifications are not to be construed as requiring enclosures or heat for operations that are not economically feasible to protect in the judgment of the Engineer. Included in the preceding category, without limitation, are such items as site work, excavation, pile driving, steel erection, erection of certain "exterior" wall panels, roofing, and similar operation.

1.02 SUBMITTALS

A. Within 30 calendar days after execution of this contract the Contractor shall submit the proposed methods for "Weather Protection". The Shop Drawing submittal shall be in accordance with Specification Section 01300.

1.03 WEATHER PROTECTION

A. Weather Protection shall be provided for protection of that work adversely affected by moisture, wind and cold, by covering, enclosing and/or heating. This protection shall provide adequate working areas during dates consistent with the approved Progress Schedule to permit the continuous progress of all work necessary to maintain an orderly and efficient sequence of construction operations.

B. Furnish and install all enclosures and be responsible for all costs, including heating required to maintain a minimum temperature of 40 degrees F., at the working surface. This provision does not supersede any specific requirements for methods of construction, curing of materials or the applicable general conditions set forth in the Contract Documents with added regard to performance obligations of the Contractor.

C. Installation of weather protection and heating devices shall comply with all safety regulations including provisions for adequate ventilation and fire protection devices. Heating devices which may cause damage to finish surfaces shall not be used.

PART 2 PRODUCTS NOT USED

PART 3 EXECUTION NOT USED

END OF SECTION

SECTION 01560

TEMPORARY CONTROLS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Requirements for cleaning, maintenance of the site, barriers and fences required during construction.

1.02 CLEANING DURING CONSTRUCTION

A. Unless otherwise specified under the various trade Sections of the Specifications, the Contractor shall perform clean-up operations during construction as herein specified.

1. Control accumulation of waste materials and rubbish; periodically dispose of off-site. Bear all costs, including fees resulting from disposal.
2. Clean interior areas prior to start finish work and maintain areas free of dust and other contaminants during finishing operations.
3. Maintain project in accordance with all local, State and Federal Regulatory Requirements.
4. Store volatile wastes in covered metal containers, and remove from premises.
5. Prevent accumulation of wastes that create hazardous conditions.
6. Provide adequate ventilation during use of volatile or noxious substances

B. 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 or 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. Use only those materials which will not create hazards to health or property and which will not damage surfaces.
5. Use only those cleaning materials and methods recommended by manufacturer of surface material to be cleaned.
6. Execute cleaning to ensure that the buildings, the sites, and adjacent properties are maintained free from accumulations of waste materials and rubbish and wind blown debris, resulting from construction operations.
7. Provide on-site containers for collection of waste materials, debris, and rubbish.
8. Remove waste materials, debris, and rubbish from the site periodically and dispose of at legal disposal areas off the construction site.
9. Handle material in a controlled manner with as little handling as possible. Do not drop or throw materials from heights.
10. Schedule cleaning operations so that dust and other contaminants resulting from cleaning process will not damage surrounding surfaces.
11. During its progress, the work and the adjacent areas affected thereby shall be kept cleaned up and all rubbish, surplus materials, and unneeded construction

equipment shall be removed and all damage repaired so that the public and property owners will be inconvenienced as little as possible.

12. Where material or debris has washed or flowed into or been placed in existing watercourses, ditches, gutters, drains, pipes, structures, work done under this contract, or elsewhere during the course of the Contractor's operations, such material or debris shall be entirely removed and satisfactorily disposed of during the progress of the work, and the ditches, channels, drains, pipes, structures, and work, etc. shall, upon completion of the work, be left in a clean and neat condition.

1.03 DUST CONTROL

A. Provide adequate means for the purpose of preventing dust caused by construction operations throughout the period of the construction contract.

B. This provision does not supersede any specific requirements for methods of construction or applicable general conditions or performance obligations of the Contractor.

1.04 EROSION AND SEDIMENT CONTROL

A. Plan and execute construction by methods to control surface drainage from cuts and fills, from borrow and waste disposal areas. Prevent erosion and sedimentation.

B. Minimize amount of bare soil exposed at one time.

C. Provide temporary measures such as berms, dikes, and drains, to prevent water flow.

D. Construct fill and waste areas by selective placement to avoid erosive surface silts for clays.

E. Periodically inspect earthwork to detect evidence of erosion and sedimentation; promptly apply corrective measures.

F. Construct sediment control devices for discharge from dewatering trenches.

G. Construct all sedimentation control devices shown on the plans.

1.05 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.

1.06 POLLUTION CONTROL

A. Special care shall be taken to prevent contamination or muddying up or interfering in any way with the stream flows, if any along the line of work. No waste matter of any kind will be allowed to discharge into the stream flows or impounded water of any pools or other bodies of water.

1.07 SURFACE WATER CONTROL

A. Take all precautions to prevent damage to the work or equipment by high waters or by storms. The Engineer with the approval of the Owner may prohibit the carrying out of any work at any time when in his judgment, high water or storm conditions are unfavorable or not suitable, or at any time, regardless of the weather, when proper precautions are not being taken to safeguard previously constructed work or work in progress.

B. In case of damage caused by the failure of the Contractor to take adequate precautions, the Contractor shall repair or replace equipment damaged and shall make such repairs or rebuild such parts of the damaged work, as the Engineer may require, at no additional expense to the Owner.

1.08 BARRIERS AND ENCLOSURES

A. Fences and Barricades

1. Provide and maintain temporary fences, barriers, lights, guardrails, and barricades as indicated in the Contract Documents, or as necessary to secure the Work and adjacent property, and protect persons and property.
2. Obtain necessary approvals and permits and provide temporary expedients as necessary to accommodate tasks requiring items mentioned herein.

B. Protection of Trees

1. The Contractor shall take care not to harm trees along the sides of roads or with in the existing facility in which the construction work is to be done or trees on adjacent lands except as indicated on the drawings or with the written permission of the Owner and any other owner of the trees involved. Care shall be taken not to cut tree roots so as to harm the growth of trees to remain.
2. If, in the opinion of the Engineer, any trees damaged during construction can be repaired, the Contractor shall satisfactorily repair same at no further cost to the Owner.
3. If, in the opinion of the Engineer, any tree damaged during construction cannot be repaired and should be removed, the Contractor shall satisfactorily remove and replace, in kind, same at no further cost to the Owner.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

END OF SECTION

SECTION 01600

MATERIALS AND EQUIPMENT

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes

1. Requirements for delivery, storage, handling and installation of systems, materials, manufactured units, equipment, components, and accessories used in the work.

B. Related Sections

1. Section 01300 - Submittals

1.02 DELIVERY

A. Refer to Specifications' Sections for requirements pertaining to delivery and handling of materials and equipment.

B. Transport products by methods to avoid product damage; deliver in undamaged condition in manufacturers' unopened containers or packaging, dry.

C. Provide equipment and personnel to handle products by methods to prevent soiling or damage.

D. Promptly inspect shipments to assure that products comply with requirements, that quantities are correct, and products are undamaged.

1.03 STORAGE AND PROTECTION

A. Refer to Specifications' Sections for requirements pertaining to storage and protection of materials and equipment.

B. Store products in accordance with manufacturers' instruction, with seals and labels intact and legible. Store sensitive products in weather tight enclosures; maintain within temperature and humidity ranges required by manufacturers' instructions.

C. For exterior storage of fabricated products, place on sloped supports above ground. Cover products subject to deterioration with impervious sheet covering; provide ventilation to avoid condensation.

D. Store loose granular materials on solid surfaces in a well-drained area; prevent mixing with foreign matter.

E. Arrange storage to provide access for inspection. Periodically inspect to assure that products are undamaged, and are maintained under required conditions.

1.04 INSTALLATION STANDARDS

A. Comply with Specifications and referenced standards as minimum requirements.

B. Components required to be supplied in quantity within a Specification Section shall be the same, and shall be interchangeable.

C. Do not use materials and equipment removed from existing structures, except as specifically required, or allowed, by the Contract Documents.

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, and racking.

F. When work is specified to comply with manufacturers' instructions, submit copies as specified in Section 01300 - Submittals, distribute copies to persons involved, and maintain one set in field office.

G. Perform work in accordance with details of instructions and specified requirements.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

END OF SECTION

SECTION 01665

SERVICES OF MANUFACTURER'S REPRESENTATIVES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Requirements for services provided by manufacturer's representatives.

1.02 SERVICES OF MANUFACTURER'S REPRESENTATIVES

A. General

1. Arrange for a qualified factory trained service representative from each company manufacturing or supplying certain equipment and systems, as listed in the Table at the end of this section and as specified in Division 11 through Division 16, to perform the duties described herein.
2. Qualified factory trained service representative shall be approved by the Engineer
3. All 8-hour days specified herein and in other sections of the specifications are exclusive of travel time
4. Since the specified pre-startup operator training and post-startup services will be integrated into a plant-wide schedule, the Owner may redistribute the total number of instructor hours between pre- and post startup services.

B. Supervision of Installation

1. Provide on-site supervision and advice to the Contractor to insure that proper procedures are followed during equipment installation.

C. Equipment Checkout

1. Inspect, align, operate, test and adjust the equipment after equipment installation has been completed and equipment is presumably ready for operation, but before it is operated by others.
2. The inspection shall include, but shall not be limited to, the following points as applicable:
    a. Soundness (without cracked or otherwise damaged parts)
    b. Completeness in all details as specified
    c. Correctness of setting, alignment, and relative arrangement of various parts
    d. Adequacy and correctness of packing, sealing and lubricants.
3. Operate, test and adjust the equipment, as required, to prove that the equipment is left in proper condition for satisfactory operation under the conditions specified.

4. Upon completion of the work, submit a complete signed report of the result of the inspection, operation, adjustments and tests to the Engineer via the Contractor. The report shall include:

    a. Detailed descriptions of the points inspected and work completed
    b. Deficiencies noted and/or corrected
    c. Tests and adjustments made
    d. Quantitative results obtained if such are specified
    e. Suggestions for precautions to be taken to ensure proper maintenance
    f. A certificate that specifically states that "… the equipment conforms to the requirements of the Contract and is ready for permanent operation and that nothing in the installation will render the manufacture's warrantee null and void".

D. Field Acceptance Test

1. Tests shall be conducted by the Contractor, with assistance from the manufacturer's representative, after the Engineer has reviewed completed and equipment checkout report

2. Manufacturer's representative shall be present during field acceptance tests.

E. Pre-Startup Operator Training

1. General

    a. Provision for classroom and hands on training to plant personnel in the operation and maintenance of the equipment prior to placing the equipment in full operation.
    b. Provide the Owner's personnel and their consultants with sufficient information and skills training on the theory, design, site specific operation and maintenance practices (including items such as routine monitoring with normal and abnormal parameters, troubleshooting techniques, and preventive and corrective maintenance requirements) to insure that equipment and systems can be efficiently and effectively operated and maintained by the trainees upon completion of the training.
    c. Training shall be a combination of classroom, field observance and hands-on applications.
    d. Provide the following as specified herein:
        1) Lesson Plans
        2) Trainee Manuals
        3) Catalog of training materials
    e. The Contractor shall provide a credit to the Owner for any unused instructor hours.
    f. Training classes shall be based on the approved Contractor Operation and Maintenance Manual.
    g. Conduct the training at scheduled times in accordance with the Contractor's approved comprehensive training schedule for all equipment, system and

components. All training shall be coordinated and scheduled with the Owner a minimum of 7 days in advance. All training sessions will be conducted during the day shift. Currently the day shift is approximately 7:00 AM to 3:00 PM. For scheduling and training effectiveness, no one class will be longer than 4 hours.

2. Operations Sessions

   a. Overview of the equipment and its' auxiliary support/systems covering nomenclature, function and theory of operation.
   b. General safety requirements for operation of the equipment and its' auxiliary/support systems, including suggested safety equipment.
   c. Pre-start-up safety and equipment check.
   d. Equipment and auxiliary/support systems start-up procedures covering manual and automatic modes, if available.
   e. Routine operation and monitoring requirements; including specifics on normally expected ranges for items such as oil, water pressure and temperatures, discharge pressures, sensory observations, etc., procedures to change operating parameters (such as air or flow rates).
   f. Equipment/systems shut down procedures covering manual and automatic modes (if applicable).
   g. Operational troubleshooting of equipment and auxiliary/support systems.
   h. Procedures for handling non-routine operational problems such as response to alarms, power failures, emergency shutdown, auxiliary/support system failures, etc.

3. Maintenance Sessions

   a. If session is specific to a discipline; (e.g., electrical, mechanical, I&C), include only appropriate maintenance items for the discipline. If session is to include multiple disciplines, include all items for those disciplines and indicate in submittal outline which discipline the material refers to.

   b. For All Disciplines provide:
      1) An overview of the equipment and its' auxiliary/support systems covering nomenclature, function and theory of operation.
      2) General safety requirements for maintenance of the equipment and its' auxiliary/support systems appropriate to each discipline including suggested safety equipment and practices. Cover local/remote lockout procedures, safe procedures for handling alarms and built in safety devices during preventive and corrective maintenance.
      3) Overview of pre-start-up, routine operation monitoring, and shutdown procedures covering automatic and manual modes (if applicable).

   c. For Each Specific Discipline provide:
      1) Preventive maintenance procedures to be followed; include parts' lube quantities, types, frequencies, application points, time requirements to perform procedures, etc.

Note: Information should be provided to trainees from the O&M manuals which cross references manufacturer's lube requirements.

2) Specific procedures to cover adjustment requirements for alignment, wear, calibration, etc. for all preventive maintenance and corrective maintenance procedures, including time required to perform.
3) Special tools, techniques or procedures required for either preventive or corrective maintenance of equipment or its' auxiliary support systems.
4) Assembly/disassembly procedures required for preventive or corrective maintenance, including time required to perform.
5) Maintenance troubleshooting of equipment and auxiliary/support systems.

F. Post-Startup Services

1. Provision for assistance to the Owner in the calibration, tuning and troubleshooting, plus any additional training which may be required during the one-year guarantee period.

1.03 SUBMITTALS

1. Submit instructor qualifications, training outline, and lesson plans 90 calendar days prior to pre-startup operator training. Qualifications of the factory trained service representative, as defined below.
2. Submit trainee manuals at least 30 calendar days prior to scheduled training.
3. Training Outline/ Lesson Plans:
   a. 4 copies
   b. Training outline/lesson plans to cover each major trainee group (i.e.: operations, electrical maintenance, instrumentation, etc). If the same session outline is to be used for more than one type of trainee group, such as one which would cover equipment identification and principals of operation, this information should be so indicated on the outline. The outline should be detailed and include length of session for each major topic and type of session; i.e., field or classroom.
   c. The lesson plan shall be cross referenced to the trainee manuals provided and include instructor references for the use of training aids, training strategies, etc. They should contain sufficient technical material to guide the instructor in the delivery of the training material session. Lesson plans are to be provided for each separate technical discipline to be trained. Generic "informational" lesson plans may be used for multiple trainee discipline target groups. The specific number of lesson plans for each session will be determined by the complexity, content and objectives of the subject equipment covered.
   d. The purpose of the manual is to provide specific guidance for the instructor and the trainees on what is to be taught and how, as well as to insure consistency and completeness of the sessions when they are presented to different groups of the same target trainee group.

4. Trainee Manuals

   a. **4** copies for review. **6** final copies.
   b. Key trainee manuals to the training outline. Copies should be available to pass out to each trainee at the session, they are to be retained by the trainee for future use. This trainee manual is not the O&M manual required in the specification, however, similar materials may be included as appropriate.
   c. The purpose of the manual is to provide an organized package of information for the trainee, which will be used during the training sessions as well as for future reference material.
   d. The organization of the manual should correspond to the training outline. Material in the manual should include information on the training topics, the training outline, and other relative reference material. Specifically, all manuals should be geared toward an eighth grade level of reading.
   e. Manuals for Operations training sessions should include a description of the equipment, pre-start-up checks, start-up and shutdown procedure, specific monitoring checks including expected parameters, troubleshooting and safety procedures, etc. as described previously.
   f. Manuals for Maintenance training sessions should include a description of the equipment, pre-start-up checks, start-up and shutdown procedure, specific monitoring checks including expected parameters, troubleshooting and safety procedures, etc. as described previously.

5. 2 copies of a catalog of all training materials including training outline, lesson plans and trainee manuals.

1.04 QUALITY ASSURANCE

A. Qualifications

1. Factory trained service representative shall have the training and experience to provide technical and/or process related advice, and/or assistance, relating to the installation, operation, maintenance and utilization of the products that he represents. Additional qualifications may be specified elsewhere.
2. Representative is subject to acceptance by Engineer. No Substitute representatives will be allowed unless prior written approval by Engineer has been given.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

A. Equipment and Components Requiring Services is listed in the Table at the end of this section.

B. Provide a credit to the Owner for unused service manhours as specified below, at the manufacturer's published field service rate plus travel costs.

SERVICES OF MANUFACTURER'S REPRESENTATIVE
Manhour Requirements Table

Specification Section	Section Number	Supervision of Installation	Equipment Checkout	Field Acceptance Tests	Pre-Startup Operator Training	Post-Startup Services
Water Pumps	11215	8	8	16	8	8
Grinder Pump	11311	4	4	4	4	4
Surge Relief Valve	15100	4	4	4	4	4
HVAC Equipment	15300	4	4	4	4	4
Variable Frequency Drives	16495	4	4	4	4	4
Engine/Generator	16612	8	4	4	4	4

EQUIPMENT CERTIFICATION

Owner:_____ Date: _____

_____

Project: _____

_____

Contractor: _____

_____

Equipment Manufacturer: _____

_____

Equipment: _____

Specification Section: _____

As an authorized representative of the Equipment Manufacturer, the undersigned certifies that the equipment listed above conforms to the requirements of the construction contract between the Contract and the Owner. The undersigned further certifies that the equipment has been installed in accordance with the Manufacturer's written instructions, that the equipment is ready for permanent operation and that nothing in the installation will render the Equipment Manufacturer's warranty null and void.

_____ Date: _____

(Authorized Manufacturer's Representative)

_____ Date: _____

(Witness)

Remarks:_____

_____

_____

_____

_____

EQUIPMENT TRAINING CERTIFICATION

Owner:_____ Date: _____

_____

Project: _____

_____

Contractor: _____

_____

Equipment Manufacturer: _____

_____

Equipment: _____

Specification Section: _____

As an authorized representative of the Equipment Manufacturer, I certify that I have trained the Owner's personnel in the proper operation and maintenance of the above equipment.

_____ Date: _____

(Authorized Manufacturer's Representative)

The following personnel listed below attended the training session(s):

_____

_____

_____

_____

_____ Date: _____

(Owner's Representative)

_____ Date: _____

(BETA Group, Inc. Witness)

END OF SECTION

SECTION 01680

EQUIPMENT AND SYSTEM CHECKOUT,
CERTIFICATIONS AND TESTING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Requirements and procedures for physical checkout certification and testing of equipment.

1.02 DEFINITIONS

A. Shop Testing is defined as testing that is done by the manufacturer either at the place of manufacture, the place of assembly, or at another location where the required testing apparatus is located, for the purpose of proving that the equipment meets the requirements of the pertinent technical specification(s).

B. Equipment Checkout, Inspection and Certification is defined as the process of physically inspecting products after they have been installed in the work, and then certifying that the products have been properly and completely installed, and are ready for field and/or functional testing.

C. Field Testing is defined as testing that is performed by the Contractor with supplier assistance on products they have been installed in the work and after the performance of physical checkout, for the purpose of proving that the tested products meet the requirements of the pertinent technical specifications. While field testing can be described as "shop testing in the field", it may be required regardless of whether or not shop testing was performed on the same piece of equipment or material.

D. System Testing is defined as testing performed on a "system" normally comprised of two or more pieces of equipment, after the equipment has been installed in the work, and after physical checkout and field testing has been completed, for the purpose of providing that the system meets requirements as specified and as indicated.

E. Manufacturer's Representative, sometimes referred to as the Factory-Trained Service Technician, is defined as a person or persons provided by the manufacturer, who is qualified by having the training and experience to provide technical and/or process related advice, and/or assistance, relating to the installation or utilization of the products provided by that same manufacturer, for installation and utilization in the work. Such training and experience shall include a minimum of three years participation in similar

work including no less than three similar projects during this three year period. The qualifications of each representative must be submitted to the Engineer for approval at least 30 days prior to their first site visit.

F. The Testing Checkout Coordinator is defined as the person provided by the contractor to coordinate and oversee the total spectrum of testing and inspection activities required by the contract documents. The testing and checkout coordinator shall have been in responsible charge of at least two similar projects in the last four years.

1.03 ROLES AND RESPONSIBILITIES

A. The Contractor shall provide all outside services, materials, labor, supplies, test equipment and other items necessary to perform the testing specified herein. In addition, arrange for and provide the participation or assistance of survey crews, engineers, quality control technicians, manufacturers' representative(s), and required governmental agency representatives.

1.04 CHECKOUT PLAN

A. The Contractor shall submit a checkout plan based upon the requirements defined herein to the Engineer. Six copies of checkout plan (preliminary) shall be submitted for review within 90 calendar days prior to the proposed date of the first test, whichever occurs first. The plan shall define:

1. The logical and systematic performance of physical inspections, shop, field, and system tests.
2. A list of all shop tests, and supplier certifications, including those required by the applicable technical specifications. Provisions shall also be included for retesting in the event it is required.
3. Participants in the testing.
4. Special test equipment.
5. Sources of the test media (water, power, air) and the proposed method of delivery of the media to the equipment to be tested.
6. Ultimate disposal of the test media.

B. The plan shall be reviewed by the Engineer, modified or revised as necessary by the Contractor, then approved by the Engineer. The Contractor shall continue to update the checkout plan, working in conjunction with the Engineer prior to the start of the scheduled equipment checkout and functional testing activities.

C. The Contractor shall designate, in the checkout plan, a testing and checkout coordinator to coordinate and manage the activities defined in the checkout plan, as approved by the Engineer.

1.05 EQUIPMENT AND SYSTEM CHECKOUT AND CERTIFICATIONS

A. Checkout is defined as inspection by the Contractor, Engineer and Owner to verify conformance to the contract drawings and specifications. Checkout procedures will be conducted by the Contractor in the presence of the Engineer and Owner to verify the presence, appropriateness, and proper construction or installation of each being “checked out". Typical elements of the checkout include the following:

1. Verify exterior areas for backfill, grading, surfacing, drainage, landscaping, roadways, fencing, and gates.
2. Verify buildings for structure, masonry, architectural, mechanical systems, electrical/lighting, communications, and HVAC.
3. Verify concrete structures for structural integrity, finish tolerance, durability, appearance, embedded and inserted items, painting and surface applications.
4. Verify steel structures for member alignment, connection bolts torque, connection welds integrity, painting, fire proofing and surface applications.
5. Verify mechanical systems and items for setting, alignment and securing, check and adjust packing and seals, lubrication, drying out, drive connection and alignment including rotation and belt/chain tension, painting or surface applications, and tagging for project system.
6. Verify piping systems for material, size, components, direction, alignment of joints and bolts/welding, packing and seals, screens and filters and strainers, leak and pressure hydro tests, painting and color coding, hangers and anchors and expansion provision and supports, clean out of foreign matter and tagging for project system.
7. Verify electrical and control/instrumentation systems for conduit and tray installation, wire/cable material and size, circuit continuity and identification, voltage testing, ground continuity and testing, terminal installation and identification, jar switches and circuit breakers and transformers tested, substation operation tested, and tagging for project system.
8. Verify communication system including telephone, fire/smoke alarm, security, page/part, closed circuit TV similar to electrical above.
9. Verify computer systems by station, function, and network interface.

B. Each piece of equipment and system must be certified by the manufacturer's representative as specified in Section 01665 Services of Manufacturer’s Representatives.

1.06 FIELD TESTING OF EQUIPMENT

A. When required by the technical specifications, perform field testing on installed equipment. Field testing shall be in addition to and not in lieu of, any shop testing either required or otherwise performed. Perform field testing as a part of the overall equipment and system testing process defined herein and in accordance with the approved checkout plan.

B. Provide ninety days written notice indicating the date and time for testing one piece of equipment, or a series of equipment pieces. Submit with this notice the following for approval by the Engineer:

1. Description of the tests, specifically outlining how the test will prove conformance with the requirements in the technical specifications.
2. Testing devices that will be used in the tests. Description shall state what portion of the tests that the devices will perform or measure, and device accuracy.
3. Personnel used to perform the tests. Submit resumes, qualifications, and experience. As a minimum, personnel must have three years experience with the manufacturer and operation of the equipment to be tested and will have participated in five similar tests during this period of experience.
4. Schedule of testing. Schedule shall include frequency of measurements, personnel present, and contingency plans for equipment and/or test failure.
5. Test forms. Provide test forms for recording reporting on the field test data, prior to the test.
6. Material and equipment required for the test. This material and equipment shall be supplied at no additional cost to the Owner.
7. Water and Power Requirements. Water and power requirements shall be identified in the plan by the Contractor and will be supplied by the Contractor for field testing purposes. The Contractor shall provide all temporary piping and wiring required for field testing; and equipment and labor for the reuse of the test water. When testing is performed with water during freezing conditions, the Contractor shall take measures to prevent damage to the work caused by freezing of the water.
8. Operational Requirements. Include valve positions, set-ups, gate positions, including temporary arrangements that are required to run the tests so that the Owner can anticipate and plan for the testing situation.
9. Provide seven days written notice to the Engineer prior to the actual start of any testing. This will include a statement by the Contractor that the equipment and facilities to be tested have been thoroughly inspected and cleaned of construction debris or other extraneous materials and all lubrication, materials, and preparations are completed.

C. Field test procedures will be reviewed and returned by the Engineer within 30 days of receipt. Incorporate minor comments on the procedures, equipment, or personnel prior to testing. Major comments by the Engineer will require a resubmission of the field test procedure and proposed test date. The Contractor will be notified, in writing, by the Engineer if a formal resubmission is required with the transmittal of the review comments.

D. Submit within one week after completion of the tests, the following to the Engineer for approval:

1. Completed test forms for each device tested.
2. Completed certification documentation.
3. A written summary of testing, reporting on the results and summarizing the entire procedure.
4. A schedule for retesting, if necessary. Perform any retesting required to fulfill the intent of the technical specification test requirements at no additional cost to the Owner.

1.07 SYSTEM TESTING

A. Specific system tests shall be performed by the contractor in addition to the requirement for shop, field, and other tests called for in the technical specifications. System tests will be performed with fluid or gaseous substances that are generally non-septic, non-corrosive, non-toxic, and non-inflammable.

B. Provide 30 days written notice indicating the date and time during which the specific functional test is proposed. Submit with this notice, the following to the Engineer for approval:

1. Testing devices that will be used in the tests. Description shall state what portion of the tests that the devices will perform or measure, and device accuracy.
2. Personnel used to perform the tests. Submit resumes, qualifications, and experience. As a minimum, personnel must have three years experience with the manufacturer and operation of the equipment to be tested and will have participated in five similar tests during this period of experience.
3. Schedule for Testing: Schedule shall include frequency of measurements, personnel present, and contingency plans for equipment and/or system test failure.
4. Test forms. Provide test forms for recording reporting on the field test data, prior to the test.
5. Material and equipment required for the test. This material and equipment shall be supplied at no additional cost to the Owner.

6. Water and Power Requirements. Water and power requirements shall be identified in the plan by the Contractor and will be supplied by the Contractor for system testing purposes. The Contractor shall provide all temporary piping and wiring required for field testing; and equipment and labor for the reuse of the test water. When testing is performed with water during freezing conditions, the Contractor shall take measures to prevent damage to the work caused by freezing of the water.
7. Operational Requirements. Include valve positions, set-ups, and gate positions that are required to run the tests in the written request so that the Engineer can anticipate and plan for the testing.
8. Provide seven days written notice to the Engineer prior to the actual start of any testing. This will include a statement by the Contractor that the equipment and facilities to be tested have been thoroughly inspected and cleaned of construction debris or other extraneous materials and all lubrication, materials, and preparations are completed.

C. The Engineer, and the Owner may witness the performance of these tests, at their option.

D. A review of the system test package by the Engineer will be made within two weeks of receiving the package. The Contractor shall incorporate minor comments on the procedures, equipment, and personnel prior to testing. Major comments by the Engineer will require a resubmission of the system test package and test date.

E. Submit within one week after completion of the tests, the following to the Engineer for approval.

1. Completed test forms, for each device.
2. Completed certification.
3. A written summary of testing, reporting on the results and summarizing the entire procedure.
4. A schedule for retesting, if necessary, including changes to procedures, testing devices, or personnel. Any retesting required to fulfill the intent of the test requirements due to negligence, poor workmanship, or products that fail to meet the contract requirements, shall be at no additional cost to the Owner.

1.08 CORRECTIONS TO THE WORK

A. Correct any items of work failing to meet the specified requirements, at no additional cost to the Owner. Correct the nonconforming items by re-work, modification, or replacement, to the option of the Engineer. This includes the provision of all required labor, materials, and requirements for retesting as specified herein, to verify that the items conform with contract documents.

1.09 SAFETY

A. Conduct all specified test procedures in compliance with all applicable safety standards and regulations.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

END OF SECTION

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SECTION 01700

CONTRACT CLOSE-OUT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Requirements for specific administrative procedures, close-out submittals and forms used at substantial and final completion of the Work.

B. Contractor shall satisfy all administrative requirements within the Contract Documents and the Requirements listed in this section prior to Contract Close-out.

1.02 FINAL CLEANING

A. On or before the completion of the work, the Contractor shall, unless otherwise especially directed or permitted in writing, tear down and remove all temporary buildings and structures built by him; shall remove all temporary works, tools, and machinery or other construction equipment furnished by him; shall remove all rubbish from any grounds which he has occupied; and shall leave the roads and all parts of the premises and adjacent property affected by his operations in a neat and satisfactory condition.

B. The Contractor shall restore or replace, when and as directed, any public or private property damage by his work, equipment, or employees, to a condition at least equal to that existing immediately prior to the beginning of operations. To this end, the Contractor shall do as required, all necessary highway or driveway, walk and landscaping work. Suitable materials, equipment, and methods shall be used for such restoration. The restoration of existing property or structures shall be done as promptly as practicable as work progresses and shall not be left until the end of the contract period.

C. Unless otherwise specified under the various Sections of the Specifications, the Contract or shall perform final cleaning operations as herein specified prior to final inspection.

D. At completion of work, remove waste materials, rubbish tools, equipment, machinery and surplus materials, and clean all sight-exposed surfaces; leave project clean and ready for occupancy.

E. Cleaning shall include all surfaces, interior and exterior in which the Contractor have had access whether existing or new.

F. Refer to Sections of the Specifications for cleaning of specific products or work.

G. Use only those materials which will not create hazards to health or property and which will not damage surfaces.

H. Use only those cleaning materials and methods that are recommended by the manufacturer of surfaces material to be cleaned.

I. Employ experienced workmen, or professional cleaners, for final cleaning operations.

1.03 PROJECT RECORD DOCUMENTS

A. Project Record Documents also referred here as Record Drawings shall consist of all the contract drawings.

B. The Contractor shall be required to maintain one set of Record Drawings, as the work relates to their Sections of the Specifications, at the site.

C. Record Drawings shall be stored and maintained in the Contractor's field office apart from other documents used for construction. The Record Drawings shall be maintained in a clean, dry, and legible condition and shall not be used for construction purposes.

D. Record Drawings shall be available at all time for inspection by the Engineer. All deficiencies noted shall be promptly corrected.

E. The following information shall be indicated on the Record Drawings:

1. Record all changes, including change orders, in the location, size, number, and type both horizontally and vertically of all elements of the projects which deviate from those indicated on all the contract drawings.
2. The tolerance for the actual location of utilities and appurtenances within the building to be marked on the Record Drawings shall be plus or minus two (2) inches.
3. The location of all underground utilities and appurtenances referenced to permanent surface improvements, both horizontally and vertically at ten (10) ft. intervals and at all changes of direction.
4. The location of all internal utilities and appurtenances, concealed by finish materials, including but not limited to valves, coils, dampers, vents, clean outs, strainers, pipes, junction boxes, turning vanes, variable and constant volume boxes, ducts, traps and maintenance devices. The location of these internal utilities, appurtenances and devices shall be shown by offsets to the column grid lines on the drawings.

5. Each of the utilities and appurtenances shall be referenced by showing a tag number, area served and function on the Record Drawings.

F. At the end of each month and before payment for materials installed the Contractor shall review Record Drawings for purpose of payment. IF THE CHANGES IN LOCATION OF ALL INSTALLED ELEMENTS ARE NOT SHOWN ON THE RECORD DRAWINGS AND VERIFIED IN THE FIELD, THEN THE MATERIAL SHALL NOT BE CONSIDRED AS INSTALLED AND PAYMENT WILL BE WITHHELD.

G. Prior to the installation of all finish materials, a review of the Record Drawings shall be made to confirm that all changes have been recorded. All costs to investigate such conditions shall be borne by the applicable party as demonstrated by the Engineer.

H. At the completion of the contract the Contractor shall certify in writing on the title sheet of the drawings that they are complete and correct and shall submit the Record Drawings to the Engineer.

1.04 EQUIPMENT AND SYSTEM CHECKOUT, CERTIFICATIONS AND TESTING

A. Comply with requirements of Section 01680 Equipment and System Checkout, Certifications and Testing.

1.05 OPERATING AND MAINTENANCE MANUALS

A. Comply with requirements of Section 01730 Operation and Maintenance Manuals.

1.06 SPARE PARTS

A. Comply with requirements of Section 01750 Spare Parts.

1.07 LUBRICANTS

A. Comply with requirements of Section 01751 Lubricants.

1.08 WARRANTIES

A. Comply with requirements of Section 01740 Warranties.

1.09 FINAL INSPECTION

A. The Contractor shall submit written certification that:

1. Project has been inspected for compliance with Contract Documents.
2. Equipment and systems have been tested in the presence of the manufacturers representative and are operational and satisfactory.

3. Project is completed, and ready for final inspection.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

END OF SECTION

SECTION 01710

STARTUP

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Startup requirements for processes, equipment and components, and the roles and responsibilities of the Contractor and the Owner.

1.02 DEFINITIONS

1. Startup: The initial operation of a sufficiently completed facility and/or plant by the Owner, utilizing water.

1.03 DESCRIPTION OF WORK

A. The primary responsibility for startup rests with the Contractor with assistance from the Owner as specified herein.

B. The Contractor shall not operate any of the existing facilities at any time. This shall include the starting and stopping of equipment or opening and closing of valves. Whenever the Contractor believe his work will effect or be effected by the existing facilities operation he shall so notify the Engineer in writing three (3) working days prior to the intended start of the work. This notification shall clearly detail the work to be completed, the method by which the existing facilities operation may be effected and the assistance requested of the Owner.

C. The Contractor shall, upon orders by the Engineer, startup, adjust and place in satisfactory operation all plant equipment constructed under each Phase of this Contract and shall be responsible to pay the cost of all utilities until the Engineer certifies the dates of substantial completion.

D. At the discretion of the Engineer, individual startups may be required for various phases of the work. If this occurs, the phase startups will be ordered by the Engineer when the following has been completed for all equipment and systems within each Phase. The Engineer may order the startups prior to the completion of non-essential items of work.

1. Compliance with Section 01665 Services of Manufacturer's Representatives, including:

a. Supervision of Installation
b. Equipment Checkout
c. Field Testing of Equipment
d. Pre-Startup Operator Training

2. Compliance with requirements of Section 01680 Equipment and System Checkout, Certifications and Testing
3. Compliance with requirements of Section 01730 Operation and Maintenance Manuals
4. Compliance with requirements of Section 01751 Lubricants

E. The Contractor shall be responsible for maintaining all equipment until the dates of substantial completion.

F. The Contractor shall assist the Owner during startup in any way deemed appropriate by the Engineer.

G. There will be a date of substantial completion certified by the Engineer. This date will not be certified until the following requirements have been satisfied by the Contractor:

1. All Contract requirements are coordinated into a fully operational system. All individual units of equipment and treatment processes are fully operative and performing at specified efficiencies. Where efficiencies are not specified, performance must meet acceptable standards for the particular unit.
2. All field tests have been completed and satisfactorily reports forwarded to the Engineer.
3. All pre-startup training has been completed by the manufacturer's representatives.
4. All spare parts and lubricants have been satisfactorily delivered to the Owner.

1.04 ROLES AND RESPONSIBILITIES

A. Contractor’s Responsibilities

1. Startup
   a. Develop specific startup plans and schedule.
   b. Provide specific startup material and operating supplies until substantial completion or until acceptance of a specific system. Supplies include lubricants, chemicals, gases, specialized fluids, electric power, water and all other required appurtenances.
   c. Provide the necessary craft or labor assistance, in the event of an emergency equipment failure requiring immediate attention, (emergency is defined as a failure of function which precludes the further operation of a critical segment of; or the whole of the work) with a response time of not less than four hours from the time of notification. The time of notification is defined as the time of contact between the Engineer's representative and the Contractor's representative.

d. Clarify submittals, testing requirements, schedules, or other items related to the startup of the equipment and facilities specified and indicated in the Contract Documents.
e. Correct all failures or equipment problems identified during startup when notified by the Engineer.
f. Attend meetings related to the review of startup plan(s).

2. Performance Testing (where specified in individual technical specifications Sections 11 through 16).

a. Review procedures for performance testing.
b. Provide manufacturer's representative to provide guidance during performance testing.
c. Provide manufacturer's representatives and operating supplies for retesting of systems that fail to pass the initial performance tests due to deficiencies in products or workmanship at no additional cost to the Owner.
d. Resolve and correct all equipment or system failures during the performance testing.

3. Provide to the Engineer a list of 24 hour, "on call" representative supervisory persons who will monitor the startup and performance testing.

B. Owner’s Responsibilities

1. Assist in the startup testing activities. The Owner will endeavor to be cooperative with the Contractor when required. However, it is emphasized that the existing facilities operations and treatment take precedence and only requests that do not adversely affect the flow or treatment will be considered. Additionally, any assistance given to the Contractor must be completed when the Owner's schedule and manpower permit. There may be instances when the Owner cannot provide assistance at the time of the Contractor's request and this shall not be the basis for a claim by the Contractor.

2. Provide staff to operate and maintain equipment, systems, and facilities requiring startup.

1.05 SUBMITTALS

A. Specific Startup Plans and schedule for all phases of startup.

B. List of 24-hour "on call" representative supervisory persons

END OF SECTION

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SECTION 01730

OPERATION AND MAINTENANCE MANUALS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Requirements for compiling and submitting operation and maintenance manuals.

1.02 OPERATION AND MAINTENANCE MANUALS

A. General

1. Include all elements and components of the system including instrumentation. Provide a description of how the equipment or complete system works. Additionally, where a number of components are furnished to provide a complete system, describe the operation of components as they relate to the complete system.
2. Include all necessary instruction for the maintenance and operation of the equipment or system in accordance with the manufacturer's recommendations, and as herein specified.
3. Customize the manual so that only data pertaining to the specific equipment or system to be furnished is included. If a standard type manual is utilized, it shall be neatly annotated to highlight the data pertaining to, and deleting the data not pertaining to, the specific equipment or equipment being furnished.
4. Bind each manual for each type of equipment or system separately as specified below

B. Content of Manuals

1. Table of Contents and index. Provide title of Contract and schedule of products and systems, indexed to content of the volume.
2. Brief description of each system and components. Identify function, normal operating characteristics and limiting conditions. Include performance curves, with engineering data and tests. Include equipment Nameplate Data (Serial No., Model No., rating, voltage, etc.).
3. Names, addresses, and telephone numbers of subcontractors and suppliers, including local source of supplies and replacement parts.
4. One copy of each approved shop drawing and each Contractor's coordination and layout drawing
5. Record drawings of wiring diagrams and control schematics including external connection diagrams.

6. Test and balancing reports, calibration data, alignment records, and other information.
7. Copy of any applicable warranties, guarantees and bonds
8. Operating Procedures:
    a. Include start-up, break-in, and routine normal operating instructions and sequence. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.
    b. Manufacturer's printed operating instructions.
9. Maintenance Procedures:
    a. Complete maintenance instructions (include routine, preventive and corrective maintenance).
    b. Manufacturer's printed maintenance instructions, parts list, illustrations, and diagrams.
    c. Include maintenance schedule and types of lubricants. Cross-reference lubricants to products offered by at least three major lubricant suppliers.
10. Spare Parts:
    a. List of recommended spare parts, manufacturer's current price, and recommended quantity
    b. Parts lists to include the specific part or identification number used by the manufacturer of the parts. Arbitrary sequential numbers or letters keyed to a sectional diagram are not satisfactory.
11. Additional Requirements: As specified in individual product specification sections.

C. Format

1. Binder
    a. Binders: Commercial quality, 8-1/2 x 11 inch three-ring binders with hardback, cleanable, plastic covers; two inch maximum ring size. When multiple binders are used, correlate data into related, consistent groupings. Provide a table of contents in each binder.
    b. All binders to be of similar design and color, but sized to sized to suit the individual manuals with a minimum allowable edge of width of 1 inch.
    c. Identify each manual with a permanent label affixed to the outside binding of the binder and include the following information:
        1) Name of Contract, Contract Number
        2) Location of equipment or system (i.e. Grove Street Pumping Station)
        3) Common name of equipment or system (i.e. Water Booster Station)
    d. Provide tabbed fly leaf for each separate product and system, with typed description of product and major component parts of equipment.

2. Material for Content

    a. Loose leaf on 60 pound, punched paper
    b. Holes reinforced with plastic cloth or metal
    c. Page size, 8 1/2 by 11 inches
    d. Diagrams, illustrations, and attached foldouts as required, of original quality, reproduced by dry copy method
    e. Drawings: Provide with reinforced punched, binder tab. Bind in with text; fold larger drawings to size of text pages

1.03 SUBMITTALS

A. Sample of typical binder, cover and tabbed fly leaf.

B. Provide an electronic copy and six (6) copies of O&M manuals for approval no later than the time that the equipment is delivered to the site. If the manual is satisfactory, the Engineer will retain all six (6) copies. If the manual is not satisfactory, the Engineer will retain one (1) copy and return five (5) copies to the Contractor. When manuals are resubmitted, a revised electronic copy and six (6) copies will again be required. When the manual is satisfactory, except for some missing information, the Engineer may, at his option, retain all six (6) copies of the manual and request six (6) copies of the additional information and a revised electronic copy be provided.

C. All manuals pertaining to equipment or a system within each specific components of construction must be completely approved prior to the Field Acceptance Tests of that component.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

END OF SECTION

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SECTION 01740

WARRANTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. General administrative and procedural requirements for warranties required by the Contract Documents, including manufacturers standard warranties on products and special warranties.

1.02 SUBMITTAL

A. Submit written warranties to the Owner prior to the date fixed by the Engineer for Substantial Completion. If the Certificate of Substantial Completion designates a commencement date for warranties other than a date of Substantial Completion for the Work, or a designed portion of the Work, submit written warranties upon request of the Owner.

B. 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 prior to acceptance of this portion of the Work.

C. Refer to individual Sections of Division 2 through 16 for specific content requirements, and particular requirements for submittal of special warranties.

1.03 WARRANTY REQUIREMENT

A. Related Damages and Losses: When correcting warranted Work that has failed, remove and replace other Work that has been damaged as a result of such failure or that must be removed and replaced to provide access for correction of warranted Work.

B. Reinstatement of Warranty: When Work covered by a warranty has failed and been corrected by replacement or rebuilding, reinstate the warranty by written endorsement. The reinstated warranty shall be equal to the original warranty with an equitable adjustment for depreciation.

C. 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.

D. 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.

E. Rejection of Warranties: The Owner reserves the right to reject warranties and to limit selections to products with warranties not in conflict with requirements of the contract Documents.

F. 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.

1.04 DEFINITIONS

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.

B. Special Warranties are written warranties required by or incorporated in the Contract Documents, either to extend time limits provided by standard warranties or to provide greater rights for the Owner.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

END OF SECTION

SECTION 01750

SPARE PARTS

PART 1 GENERAL

1.01 DESCRIPTION

A. Spare parts which are identical and interchangeable with original parts shall be provided with equipment as specified in each Section of the Specifications. Spare parts shall be individually packaged in boxes bearing the equipment reference, tag number, and part identification (Example: Water Pump No. 1).

B. Subsequent to the approval of the appropriate operation and maintenance manuals but prior to the delivery of the spare parts, the Contractor shall prepare and submit an itemized tabulation of all spare parts to be provided. The tabulation shall include the name of the equipment for which the spare part is intended, type of spare part, manufacturer of spare part, manufacturer model or manufacturer identification number of spare part, quantity of spare part, and page in the appropriate operation and maintenance manual detailing the parts list.

C. Spare parts shall be stored by the Contractor in a location approved by the Engineer. Unless otherwise directed by the Engineer, the Contractor shall deliver the spare parts to the Owner at the time of "Substantial Completion." Spare parts shall be stored in accordance with the manufacturer's written recommendations, and shall be protected against theft, vandalism, weather, and all other adverse conditions. Spare parts delivered to the Owner shall be in new, undamaged condition. Upon delivery to the Owner, spare parts shall be logged in against the above noted tabulation and inspected by the Contractor in the presence of the Engineer. Any missing or damaged spare parts shall be replaced by the Contractor at no additional expense to the Owner.

1.02 SPECIAL TOOLS

A. Provide special tools required for operation, service, or maintenance of the products as specified or as needed, as determined by the manufacturer’s representative.

B. Pack items to protect them during storage. Tag items and containers to clearly identify them.

1.03 CONTRACT SPECIFIC REQUIREMENTS

A. Specific requirements for spare parts for this contract are included in the technical specifications.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

END OF SECTION

SECTION 01751

LUBRICANTS

PART 1 GENERAL

1.01 REQUIREMENTS

A. The Contractor shall furnish and deliver to the Owner such oil, grease and any special lubricants that are necessary for proper operation of all equipment furnished under this contract. The quantity furnished shall be sufficient for one year's operation after the date of substantial completion. The grade of lubricants furnished shall be in accordance with the recommendations of the equipment manufacturers.

B. Subsequent to the approval of the appropriate operation and maintenance manuals but prior to the delivery of the lubricants, the contractor shall prepare and submit an itemized tabulation of all lubricants to be provided. The tabulation shall include the name of the equipment for which the lubricant is intended, its tag number, type of lubricant, manufacturer of lubricant, frequency of lubrication, quantity of lubricant required for one year, and page in the appropriate operation and maintenance manual referencing the lubricant.

C. All lubricants shall be delivered to the Owner prior to the start-up of the equipment. They shall be delivered in the manufacturer's unopened containers and shall be labeled with the equipment name for which it is to be used. At the time of delivery they shall be logged in against the above noted tabulation and inspected by the Contractor in the presence of the Engineer.

D. The Contractor shall also furnish and deliver to the Engineer such grease guns and auxiliary lubricating devices as are required to conveniently maintain all equipment furnished. As a minimum, one grease gun and accessories will be furnished for each individual item of equipment requiring lubrication.

E. Prior to substantial completion, the Contractor shall submit an "Equivalent Lubrication Table" which shall list equivalent products from at least four major oil companies for all lubricants that will be required for all the equipment provided under this Contract.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

END OF SECTION

SECTION 01800

MAINTENANCE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Procedures for maintaining work completed under this Contract.

1.02 MAINTENANCE PERIOD

A. The general maintenance period for all construction or materials under this Contract shall be stipulated in Articles 6 and 13 of the Standard General Conditions.

B. If the Owner puts any structure or equipment to use prior to acceptance of all work under the Contract, the maintenance period for such structures or equipment shall be calculated from the time use begins.

C. Contractor agrees to replace the material which does not conform to the Contract requirements, and to repair any damage of material or work without cost to the Owner, to satisfaction of Engineer, in conformance with Contract Documents provided orders for replacement and/or repairs are received in writing by the Contractor within the one year period.

D. This Section shall in no way limit the duration of the Contractor's responsibility for the correction of any defect due to workmanship or materials provided by the Contractor which are not in compliance with the Contract Documents.

1.03 ABUSE OF WORK

A. Contractor is not obligated to perform work of replacement or repair that he may prove is required because of abuse by parties other than the Contractor, after the date the Owner puts to continuous use the work requiring replacements or repair, or after date the Owner has approved the Certificate of Completion.

1.04 EMERGENCY REPAIRS

A. If the Owner deems necessary, the Owner shall order replacement or repairs be undertaken within 24 hours.

B. If the Contractor delays or fails to make the ordered replacement or repairs within the time specified, the Owner shall have the right to make such replacements or repairs

and the expense shall be deducted from moneys due the Contractor, or moneys of the Contractor retained by the Owner.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

END OF SECTION

DIVISION 02

SECTION 02050

DEMOLITION

PART 1 GENERAL

1.01 SUMMARY

A. Section includes requirements for demolition of existing facilities and removal of equipment and materials for reuse or salvage.

B. Items scheduled for demolition are shown on the Contract Drawings.

C. Items or areas scheduled for partial or selective demolition are shown on the Contract Drawings.

D. Refer to Specification Section 02082 for Asbestos Abatement and Specification Section 02090 for Lead Based Paint.

E. Refer to Specification Section 01060 for removal of above ground storage tank permit requirements.

1.02 SUBMITTALS

A. Shop Drawings
   1. In accordance with Specification Section 01300

B. Quality Assurance/Control Submittals

   1. Methods of demolition and equipment proposed for use in demolition
   2. Copies of Permits required for demolition.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

3.01 PREPARATION

A. Utilities
   1. Notify Owner to turn off affected services prior to demolition.
   2. Remove utilities to be abandoned as a result of demolition.
   3. Seal water, sewer, drainage and gas utilities and services as shown on Contract Drawings using plugs, caps or seals as needed.

4. Temporary Water Bypass system shall be installed, started up and tested prior to any demolition work.

B. Equipment Salvage and Reuse
   1. Do not remove equipment or materials without approval of Engineer.
   2. Properly store and maintain equipment and materials to be reused in the Work.

3.02 SEQUENCE

A. See Section 01800 - Maintenance.

3.03 SAFETY

A. Protect persons and property throughout progress of work.

B. Have acceptable fire extinguishers available at all times where demolition by burning torches is being conducted.

C. Burning of demolition debris not permitted on or near site.

D. Explosives not to be used or brought to site without prior written permission by Engineer.

E. Maintain circulation of traffic within area of demolition operations.

F. Provide and maintain lights, barriers and temporary passageways for safe access within area of demolition operation.

G. Take precautions to minimize spread of dust and flying particles. Keep work area wetted down to prevent dust from rising.

H. Provide maximum practical protection from inclement weather to materials, equipment and personnel in partially dismantled structures.

3.04 DEMOLITION

A. Dismantle and remove existing piping, pumps, motors, equipment and other appurtenances indicated without damaging existing structures, equipment and appurtenances to remain.

B. Confine demolition work, new construction and operations to areas that will not interfere with continued use and operation of water pump station.

C. Floors and/or roofs, shall not be overloaded. Complete demolition on upper levels before disturbing supporting members on lower levels. Provide storing and bracing where necessary to prevent settlement or displacement of existing or new structures.

D. On exposed surfaces, at the joint between old and new concrete, the existing concrete shall be removed to a straight rather than a rough line.

E. Piping
   1. Remove piping to be abandoned as indicated, specified and directed by Engineer or if it interferes with new work.
   2. Remove to nearest solid support, cap and leave in place piping not indicated to be removed or interfering with new work.
   3. Piping to be removed which passes through an existing wall shall be cut off and properly capped on each side of the wall.
   4. Underground piping to be abandoned and remain shall be properly capped unless it interferes with new structures or as indicated, specified and directed by Engineer.

3.05 REPAIR/RESTORATION

A. Repair or remove and replace items not scheduled for demolition damaged by Contractors operations to original condition as directed by Engineer.

B. The Contractor shall exercise extreme caution when removing sections of concrete from slabs or walls that are to be utilized as part of the new construction. Demolition shall be to the exact limits indicated on the Drawings. Over-excavated concrete shall be replaced at the Contractor's expense and to the satisfaction of the Engineer. Any damage to the remaining structure caused by the Contractor's operations shall be satisfactorily repaired at the Contractor's expense.

3.06 DISPOSAL

A. The contractor shall provide a disposal plan for approval by the Owner and Engineer. Contractor shall provide all receipts, bills of lading, manifests and other applicable documentation for any offsite disposal.

B. All mechanical equipment, including generators, interior piping and other appurtenances indicated on the drawings or specified and directed by Engineer to be demolished or removed will be removed from the property of the Owner immediately after disassembly and will become the property of the Contractor. The Owner reserves the right to remove any equipment or piping prior to signing of the agreement.

C. Debris from structures, including concrete, masonry, steel or other rubble shall become the property of the Contractor, unless otherwise directed by the Engineer, and shall be promptly removed from site at the Contractor's expense.

3.07 CLEANING

A. Leave affected areas of demolition in a clean, safe and orderly condition, ready to accept new work if proposed.

END OF SECTION

SECTION 02076

ASBESTOS-CEMENT PIPE REMOVAL

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. General Provisions of Contract, including General Supplementary Conditions shall apply to this Section.

B. Asbestos Cement Pipe (ACP) Project Checklist; refer to the form at the end of this Section.

C. N/A

D. N/A

E. Related Sections

1. 01025 – Measurement & Payment
2. 02080 – Soil and Waste Management
3. 02140 - Dewatering

1.02 SCOPE OF WORK

A. Work outlined in this Section includes all work necessary for the removal, packaging, transporting, and disposing of identified or assumed asbestos-cement pipe (ACP) and asbestos-containing waste material (ACWM) specified herein, and required to complete the installation of the replacement piping as shown on the drawings. The Contractor's work shall be performed with qualified persons with appropriate worker training in accordance with MADLS Regulation 453 CMR 6.00. Alternatively, work involving the removal of non-friable, asbestos-cement pipe may be performed by workers with (minimum) MADLS-approved, 8-hour specialized OSHA Class II Asbestos Training: Asbestos-Cement Pipe (ACP) Worker Safety course.

B. The Contractor shall inform and include the Owner in all communications with any regulatory authorities during the project or having to do with the project. This includes initial asbestos notification (ANF-001) filing and any changes to the notification (e.g., end date extensions, project closure, quantity changes, etc.).

C. If suspect ACP is uncovered during the course of excavation, the Contractor shall cease all excavation activities and consult with the Resident Engineer and Framingham DPW before proceeding.

1.03 PROJECT DESCRIPTION

A. The Work includes removal, packaging, transporting, and disposing ACP and ACWM conducted by workers meeting the requirements of OSHA Title 29 CFR, Part 1926.1101 for Class II work. This shall include all necessary excavation to access ACP for removal.

B. A portion of the Work may be performed in multiple mobilizations, at different periods of time, in conjunction with other utility/road work.

C. The Contractor shall be responsible for providing temporary water, power, heat (as needed), and trench shoring at the Site to perform the Work.

1.04 DEFINITIONS

A. The following definitions relative to ACP abatement apply:

1. Amended Water: Water to which a surfactant (wetting agent) has been added.
2. Asbestos: The name given to a number of naturally-occurring, fibrous silicates. This includes the serpentine and the amphiboles forms, and includes chrysotile, amosite, crocidolite, tremolite, anthophyllite, and actinolite, or any of these forms, which have been chemically-altered.
3. Asbestos Cement Pipe (ACP): Fiber-reinforced cement pipe where the reinforcing fibers are asbestos.
4. Asbestos Competent Person: One who is capable of identifying existing asbestos hazards and selecting the appropriate control strategy for asbestos exposure and who has the authority to eliminate them.
5. Asbestos-Containing Waste Material (ACWM): Any friable ACM removed during a demolition/renovation project and anything contaminated in the course of a demolition/renovation project including asbestos waste from control devices, bags or containers that previously contained asbestos, contaminated clothing, materials used to enclose the work area during the demolition/renovation operation, and demolition/renovation debris.
6. Asbestos Notification Form (ANF-001): Official form used to notify MassDEP and MADLS prior to the start of an asbestos abatement project.
7. Asbestos Project Designer: The MADLS-certified Asbestos Project Designer.
8. Asbestos Project Monitor: A professional capable of conducting air monitoring and analysis of schemes. This individual should be an industrial hygienist, an environmental scientist, or a Consultant with experience in asbestos air monitoring, personal protection equipment, and ACP removal procedures. This individual should have demonstrated proficiency in conducting air sample collection in accordance with OSHA Title 29 CFR, Parts 1910.1001 and 1926.1101.
9. Asbestos Supervisor: Any employee of a MADLS-licensed Asbestos Abatement Contractor who possesses a valid MADLS certification and EPA accreditation as an Asbestos Supervisor.

10. Asbestos Work Area: A regulated area, as defined by OSHA Title 29 CFR, Part 1926.1101, where asbestos abatement operations are performed, which is isolated by physical barriers to prevent the spread of asbestos dust, fibers, or debris. The regulated area shall comply with requirements of regulated areas for demarcation, access, respirators, prohibited activities, competent persons and exposure assessments and monitoring.
11. Asbestos Worker: Any employee of a MADLS-licensed Asbestos Abatement Contractor who possesses a valid MADLS certification and EPA accreditation as an Asbestos Worker, or any person who has completed a MADLS-approved, 8-hour specialized OSHA Class II Asbestos Training: Asbestos-Cement Pipe (ACP) Worker Safety course.
12. Consultant: A company, retained by the Owner, to provide services enumerated in this Section during asbestos removal activities.
13. Contractor: Company with qualified persons with appropriate worker training in accordance with: MADLS Regulation 453 CMR 6.00; or MADLS-approved, 8-hour specialized OSHA Class II Asbestos Training: Asbestos-Cement Pipe (ACP) Worker Safety course.
14. Deteriorated ACP: ACP that is crushed, flattened, or pulverized as determined by the Contractor's Asbestos Competent Person.
15. EPA: The United States Environmental Protection Agency.
16. HEPA Filter: High-Efficiency Particulate Air (HEPA) filter in compliance with ANSI Z9.2 1979.
17. HEPA-Vacuum Equipment: Vacuum equipment where all the air drawn into the machine is expelled through a HEPA filter with none of the air leaking past it and with a HEPA-filter as the last filtration stage.
18. MADLS: The Commonwealth of Massachusetts Department of Labor Standards.
19. MassDEP: The Commonwealth of Massachusetts Department of Environmental Protection.
20. Negative Exposure Assessment: A demonstration by the Contractor that Asbestos Worker exposure during an operation is or will be consistently below the PEL.
21. NESHAP: National Emissions Standard for Hazardous Air Pollutants regulations enforced by the EPA.
22. Non-Friable ACM: Any material that contains > 1% asbestos as determined using the method specified in EPA Title 40 CFR, Part 763, Appendix A, Subpart F, Section 1, via PLM, or is presumed to contain asbestos, that cannot be crumbled, pulverized, or reduced to powder by hand pressure (when dry).
23. OSHA: The Occupational Safety and Health Administration.
24. Owner: Framingham Department of Public Works.
25. Permissible Exposure Limit (PEL): The maximum total airborne fiber concentration to which an employee is allowed to be exposed. The limit established by OSHA Title 29 CFR, Part 1926.1101 is 0.1 fibers/cc of air as an eight (8)-hour time-weighted average (TWA), and 1.0 fibers/cc of air averaged over a sampling period of thirty (30) minutes as an Excursion Limit. The Contractor shall be responsible for maintaining work areas in a manner that this standard is not exceeded.

26. RCRA: The Resource Conservation and Recovery Act (EPA Title 40 CFR, Parts 260 - 265).
27. Regulated Area: An area established by the employer to demarcate where Class II asbestos work is conducted, and any adjoining area where debris and waste from such asbestos work may accumulate.
28. Site: Property address and facility included on Asbestos Notification Form ANF-001 as required for notification of the Work.
29. Supervisor: Competent person with appropriate 8-hour specialized OSHA Class II Asbestos Training: Asbestos-Cement Pipe (ACP) Worker Safety course.
30. Surfactant: A chemical wetting agent added to water to improve penetration into ACM.
31. Temporary ACWM Storage Location (TASL): Secure, Owner controlled area located within Framingham, Massachusetts where the Contractor shall maintain a suitable covered, locked container(s), used for the storage of ACWM for 30 days or less (from project completion) prior to transportation and disposal of ACWM at final receiving facility.
32. TWA: Time-Weighted Average.

1.05 CONSULTANT

A. The Owner shall retain a third-party, firm for the purposes of overseeing the Contractor and advising the Owner on all asbestos handling compliance requirements. The Consultant will represent the Owner during the removal project. The Contractor will regard the Consultant's direction as authoritative and binding, as provided herein, in matters particularly, but not limited to, the following:

1. Work area approval.
2. Monitoring results review.
3. Completion of various work segments.
4. Final abatement completion.
5. Data submission.
6. Daily field punch-list items.

1.06 USE OF THE CONTRACT DOCUMENTS

A. It shall be incumbent upon the Contractor to visit the Site and determine what exists, its condition, and what will be required to accomplish the Work intended by the Contract Documents. No increase in the Contract Sum will be permitted as a result of the Contractor's failure to visit the Site and understand the existing conditions.

B. All work shall comply with the Contract Documents and with applicable codes, laws, regulations, and ordinances wherever applicable. The most stringent of all the foregoing shall govern the Work.

C. It is not intended that this Section show every detail of the Work, but the Contractor shall be required to furnish, within the Contract Sum, all material and labor necessary for the completion of the Work in accordance with the intent of this Section.

D. In case of ambiguity among the Contract Documents, the more stringent requirement, as determined by the Consultant, shall prevail.

E. The Work includes making modifications as necessary, subject to approval by Owner in consultation with the Consultant, to correct any conflicts.

F. All items not specifically mentioned in the Contract Documents, but implied by trade practices to complete the Work, shall be included.

1.07 SITE EXAMINATION

A. The presence of underground ACP within the project site is unknown.

1.08 CONTRACTOR QUALIFICATIONS

A. The Contractor (including their proposed subcontractors) shall submit a record of prior experience in asbestos abatement projects, listing no less than three completed projects in the past year of similar size and scope. The Contractor shall list the experience and training of the Asbestos Supervisor (or Supervisor) and the Asbestos Abatement Workers (or Trained Workers) The information that should be included is as follows:

1. Project Name and Address
2. Owner's Name and Address
3. Consultant's Name
4. Summary of work
5. Contract Amount
6. Date of Completion
7. Extras and Changes

B. The Contractor selected must employ workers who have received the (at a minimum) MADLS-approved, 8-hour specialized OSHA Class II Asbestos Training: Asbestos-Cement Pipe (ACP) Worker Safety course. MADLS-certified Asbestos Workers (32-hour Asbestos Worker training) are also qualified to perform this work. At least one asbestos trained workers shall be on-site when any excavation work is being conducted.

1. If the Contractor intends to use an Abatement Subcontractor, the Contractor shall ensure the Subcontractor meets all contractor requirements established herein.

1.09 ADDITIONAL GENERAL REQUIREMENTS

A. The Contractor shall employ an Asbestos Competent Person, with experience on projects of similar scope and magnitude, who shall be responsible for all work involving ACP removal (as described in the Contract Documents and defined in applicable regulations) and have full-time, daily supervision of the Work during excavation activities.

B. If required by federal, state, local, or any other authorities having jurisdiction over such work, the Contractor shall allow the Work of this contract to be inspected. The Contractor shall immediately notify the Owner and Consultant and shall maintain written evidence of such inspection for review by the aforementioned parties.

C. The Contractor shall incur the cost of all fines resulting from regulatory non-compliance as issued by federal, state, and local agencies. The Contractor shall incur the cost of all work requirements mandated by federal, state, and local agencies as a result of regulatory non-compliance or negligence.

D. The Contractor shall immediately notify the Owner and Consultant of the delivery of all permits, licenses, certificates of inspection, of approval, or of occupancy, etc., and any other such instruments required under codes by authorities having jurisdiction, regardless of who issued, and shall cause them to be displayed to the aforementioned parties for verification and recording.

1.10 SUBMITTALS

A. The Contractor shall submit the following Asbestos Work Plan to the Consultant, in one complete package, prior to the pre-construction meeting and at least ten (10) business days before the start of the Work:

1. Submit a schedule to the Owner and the Consultant that defines a timetable for executing and completing the project, including work area preparations, removal, cleanup, decontamination, and final visual inspection.
2. Submit copies of all notifications, permits, applications, licenses and like documents required by federal, state, or local regulations obtained or submitted in proper fashion.
3. Submit the name and address of the hauling contractor and the landfill to be used. Also, submit current, valid operating permits and certificates of insurance for the transporter and landfill.
4. Submit a detailed, site-specific work plan including, but not limited to, work area isolation and removal methods.
5. Submit the training certificate, medical and respirator fit test records, and current, valid MADLS certification of each employee who may be on the Site (as applicable).
6. If the Contractor's Asbestos Competent Person is not conducting OSHA-required employee exposure monitoring, submit the name, address, and qualifications of the air sampling professional that the Contractor proposes to use on this project for this task. The Contractor shall note if this does not apply. Alternatively, the Contractor may submit a Negative Exposure Assessment performed within the last 12 months that documents that personnel were not exposed to asbestos levels above the established PEL.
7. Submit the name, address, and qualifications of proposed laboratories intended to be utilized for Contractor personal air sampling analysis as required by this Section (if applicable).

8. Submit detailed product information on all materials and equipment proposed for ACP removal work on this project.
9. Submit pertinent information regarding the qualifications of the Asbestos Competent Person for this project.
10. Submit a chain-of-command for the project. The chain-of-command should include the name, title, and contact number for each person listed.
11. Unless submitted as part of the Contractor's Emergency Response Plan, submit a site-specific emergency response information for the project. The emergency response information may include emergency procedures to be followed by Contractor personnel to evacuate the Site, hospital name and phone number, most direct transportation route from the Site, emergency telephone numbers, etc. If this information is contained within an Emergency Action Plan prepared by the Site's General Contractor, a copy shall be submitted for review.
12. Submit a written, site-specific Respiratory Protection Program for employees undertaking the Work, including make, model, and National Institute of Occupational Safety and Health (NIOSH) approval numbers of respirators to be used at the Site (if applicable). The Contractor shall note if the Respiratory Protection Program is not required at the Site (i.e., Negative Exposure Assessment completed within the last 12 months).
13. Submit a worker orientation plan that, at a minimum, includes a description of asbestos hazards and removal methodologies, a review of worker protection requirements, and the outline of safety procedures.

14. No work on the Site will be allowed to begin until the Owner and the Consultant approve the Asbestos Work Plan. Any delay caused by the Contractor's refusal or inability to submit this documentation in a timely manner does not constitute a cause for change order or a time extension.

B. The Contractor shall be responsible for submitting the abovementioned submittal requirements for subcontractors hired by the Contractor to address ACP.

C. The Contractor shall submit the following to the Consultant during the Work:

1. Copies of training, MADLS certifications, respirator fit test records, and medical records for new employees to start work 24 hours in advance of the new employee arriving at the Site (as applicable).

D. The Contractor shall submit the following to the Consultant during the Work on a daily basis (refer to Part 4 in this Section):

1. Completed Asbestos Cement Pipe (ACP) Project Checklist (Form 1).
2. Completed TASL Daily Transport Form (Form 1A).

E. The Contractor shall submit the following to the Consultant at the completion of the Work. The Owner reserves the right to retain payment(s) until all items are received in completion:

1. Original final completed copies of the WSR, signed by all transporters and the designated disposal site owner/operator within 30 days.
2. Original final completed copies of weight tickets, recycling tickets, and manifests for all specified materials.
3. Contractor's logs (daily activity logs, daily sign in sheets, containment sign-in sheets), and all worker training, MADLS certifications, medical records, and respirator fit test records (as applicable).
4. Copies of all OSHA personal air monitoring results.

1.11 REGULATIONS AND STANDARDS

A. The Contractor shall be solely responsible for conducting this project and supervising all work in a manner that will be in conformance with all federal, state, and local regulations and guidelines pertaining to asbestos abatement. Specifically, the Contractor shall comply with the requirements of the following:

1. EPA National Emissions Standards for Hazardous Air Pollutants (NESHAP) Regulations (Title 40 CFR, Part 61, Subpart M).
2. EPA Asbestos Hazards Emergency Response Act (AHERA) Regulations (Title 40 CFR, Part 763, Subpart E).
3. OSHA Asbestos Regulations (Title 29 CFR, Parts 1910.1001 and 1926.1101).
4. Department of Transportation (DOT) Hazardous Waste Transportation Regulations (Title 49 CFR, Parts 170 - 180).
5. MassDEP Asbestos Regulations (310 CMR 7.00 and 7.15).
6. MassDEP Asbestos Cement Pipe Guidance Document and Conditional Enforcement Discretion, June 2011, amended May 22, 2015.
7. MADLS "The Removal, Containment or Encapsulation of Asbestos" Standards for Asbestos Abatement (453 CMR 6.00).
8. Life Safety Code, National Fire Protection Association (NFPA).
9. Local health and safety codes, ordinances or regulations pertaining to asbestos remediation and all national codes and standards including American Society for Testing and Materials (ASTM), American National Standards Institute (ANSI), and Underwriter's Laboratories (UL).

1.12 EXEMPTIONS

A. Any deviations from the Contract Documents require the written approval and authorization from the Owner and Consultant. Any modifications from the standard work practices identified in MADLS Regulations 453 CMR 6.00, or MassDEP Regulations 310 CMR 7.15, or MassDEP Asbestos Cement Pipe Guidance Document and Conditional Enforcement Discretion, June 2011, amended May 22, 2015, must be requested in writing and approved in writing by both regulatory agencies.

B. When conditions deviate from the conditions and work practices established herein, the Contractor shall immediately stop work.

C. A Non-Traditional Asbestos Work Plan (NTWP) will be required if any of the following are required or occur during the project:

1. Bulk loading of soil

2. Cleanup of contaminated soil stockpile

3. Any other occurrence outside of the conditions and work practices described herein, or at the City of Framingham's discretion.

1.13 NOTIFICATIONS, POSTINGS, SUBMITTALS, AND PERMITS

A. Planned Work

1. The Contractor shall make the following notifications and provide the submittals to the following agencies prior to the start of work. Submissions may be made electronically on eDEP File. This notification is required ten (10) calendar days prior to the start of the abatement project. Upon submission, a copy of the notification shall be provided to the Consultant. The supervisor and laboratory information submitted on the form must be accurate or a revision will be required.

a. Commonwealth of Massachusetts Department of Environmental Protection
Asbestos Program
Enforcement Division
P.O. Box 4062
Boston, MA 02211

b. Commonwealth of Massachusetts Department of Labor Standards
19 Staniford Street, 2nd Floor
Boston, MA 02114

2. The minimum information included in the notification to these agencies includes:

a. Work location/address.
b. Name of Supervisor (Asbestos Competent Person).
c. Work type (water, sewer, drain, etc.)
d. Amount of asbestos to be removed.
e. Work schedule, including proposed start and completion date.
f. Asbestos removal procedures to be used.
g. Name and location of disposal site for generated asbestos waste, residue, and debris.

3. If the ACP quantity exceeds the estimated total by more than 20%, a new asbestos notification (ANF-001) will be required.

B. Emergency Notification

1. The Contractor shall request and receive the Owner's approval before filing an Emergency Asbestos Notification with MassDEP.

2. In Consultation with the Owner, the Contractor shall adhere to the following procedures when filing an Emergency Asbestos Notification Form (ANF-001).

    a. The Contractor shall contact the MassDEP Northeast Section to obtain an emergency waiver number.
    b. If no one responds at MassDEP, the Contractor shall leave a phone/email message with the following information:
        i. Work location/address;
        ii. Contractor contact information;
        iii. Work type (water, sewer, drain, etc.); and
        iv. Methodology for ACP removal (reference ASBESTOS CEMENT PIPE GUIDANCE DOCUMENT AND CONDITIONAL ENFORCEMENT DISCRETION, June 2011, amended May 22, 2015)
    c. MassDEP will issue a project specific waiver number that shall be included in the Notification.
    d. If no project specific waiver number is issued within 24-hours, the Contractor shall again contact the MassDEP Northeast Section.
    e. The Contractor shall provide the waiver number to the Owner.
    f. The Contractor shall provide the Owner with a copy of the filed ANF-001.

1.14 WORK SITE SAFETY PLAN

A. The Contractor shall establish a set of emergency procedures and shall post them in a conspicuous place at the Site. The safety plan should include provisions for the following:

    1. Injured worker evacuation.
    2. Emergency and fire exit routes from all work areas.
    3. Emergency first aid treatment.
    4. Local telephone numbers for emergency services including ambulance, fire, and police.
    5. A method to notify persons on a public right-of-way, or at adjacent private properties, in the event of an emergency requiring area closures.

B. The Contractor shall be responsible for training all workers in these procedures.

1.15 CONTRACTOR'S AIR SAMPLING RESPONSIBILITY

A. The Contractor shall independently retain an air-sampling professional or the Asbestos Competent Person shall monitor total airborne fiber concentrations in the worker breathing zones to establish conditions and work procedures for maintaining compliance with OSHA Title 29 CFR, Parts 1910.1001 and 1926.1101 (if applicable). Alternatively, a Negative Exposure Assessment completed within the last 12 months can be submitted.

B. The Contractor's air sampling professional shall document all air sampling results and provide a report to the Owner or Consultant within 48 hours after sample collection (if applicable).

C. All air sampling shall be conducted in accordance with methods described in OSHA Title 29 CFR, Parts 1910.1001 and 1926.1101 (if applicable).

1.16 PROPER WORKER PROTECTION

A. This Subsection describes the equipment and procedures required for protecting workers against asbestos contamination and other workplace hazards except for respiratory protection.

B. In accordance with OSHA Title 29 CFR, Part 1926, all workers shall receive a training course covering the dangers inherent in handling asbestos, the dangers of breathing asbestos dust, proper work procedures, and proper worker protective measures. This course must include, but is not limited to the following:

1. Methods of recognizing asbestos
2. Health effects associated with asbestos
3. Relationship between smoking and asbestos in producing lung cancer
4. Nature of operations that could result in exposure to asbestos
5. Importance of and instruction in the use of necessary protective controls, practices and procedures to minimize exposure including:
    a. Engineering controls
    b. Work Practices
    c. Respirators
    d. Housekeeping procedures
    e. Hygiene facilities
    f. Protective clothing
    g. Decontamination procedures
    h. Emergency procedures
    i. Waste disposal procedures
6. Purpose, proper use, fitting, instructions, and limitations of respirators as required by OSHA Title 29 CFR, Part 1910.134
7. Appropriate work practices for the work
8. Requirements of medical surveillance program
9. Review of OSHA Title 29 CFR, Part 1926
10. Pressure Differential Systems
11. Work practices including hands on or on job training
12. Personal Decontamination procedures
13. Air monitoring, personal and area

C. The Contractor shall provide medical examinations (as required for respirator use) for all workers who may encounter a total airborne fiber concentration of 0.1 fibers/cc or greater for an 8-hour TWA.

D. The Contractor shall maintain control of, and be responsible for, access to all work areas to ensure the following requirements:

1. Non-essential personnel are prohibited from entering the Regulated Area.
2. Asbestos waste that is removed from the work area must be properly bagged and labeled in accordance with this specification Section.
3. Any materials, equipment, or supplies that are removed from the Regulated Area shall be thoroughly cleaned and decontaminated by wet-cleaning methods and/or HEPA vacuuming of all surfaces.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Deliver all materials in the original packages, containers, or bundles bearing the brand name, manufacturer name, and product technical description.

B. The Contractor shall have a sufficient inventory of, or dated purchase orders for, materials necessary for the Work (e.g., protective clothing, respirators, respirator filter cartridges, polyethylene (poly) sheeting of proper size and thickness, tape, spray adhesive, air filters, etc.).

C. Damaged or deteriorating materials are not permitted for use and shall be removed from the premises. Material that becomes contaminated with asbestos shall be decontaminated or disposed as ACWM.

D. Poly sheeting (packaged in a roll to minimize the frequency of joints) shall be delivered to the Site with factory label indicating four (4) or six (6)-mil thickness.

E. Poly disposable bags shall be 6-mil with OSHA-required pre-printed labels (OSHA Title 29 CFR, Part 1926.1101(k)(8)(iii)).

F. Tape or adhesive spray shall be capable of sealing joints in adjacent poly sheeting, and shall be able to attach poly sheeting to finished or unfinished surfaces of dissimilar materials. Tape and adhesive spray shall also be capable of adhering under both dry and wet conditions (including use of amended water).

G. Surfactant (wetting agent) shall consist of fifty percent (50%) polyoxyethylene ether and 50% polyoxyethylene ester, or equivalent, and shall be mixed with water to provide a concentration of 1 ounce surfactant to 5 gallons of water, or as directed by manufacturer.

H. The Contractor shall have spray equipment capable of mixing wetting agent with water. Spray equipment shall be capable of generating sufficient pressure and volume; the hose length must reach all areas within the Regulated Area.

I. Impermeable containers shall be used to receive and retain any asbestos-containing or contaminated materials until disposal at an acceptable disposal site. The containers shall be labeled in accordance with OSHA Title 29 CFR, Part 1926.1101(k)(8)(iii) [June 1, 2015 requirements]. Containers must be airtight and watertight.

J. Labels and signs, as required by OSHA Title 29 CFR, Part 1926.1101, will be used.

2.02 TOOLS AND EQUIPMENT

A. The Contractor shall provide all clean tools and equipment necessary for asbestos abatement activities.

B. If required/requested by Framingham DPW, the Contractor's air monitoring professional or Asbestos Competent Person shall have air-monitoring equipment of type and quantity to monitor operations and conduct personnel exposure surveillance per OSHA requirements. The equipment shall function properly and air samples shall be calibrated with a recently calibrated (within 6 calendar months) rotometer.

C. The Contractor shall have available sufficient inventory or dated purchase orders for materials necessary for the Work, including protective clothing, respirators, respirator filter cartridges, poly sheeting of proper size and thickness, tape, spray adhesive, and air filters.

D. The Contractor shall provide (as needed) temporary electrical power panels, electrical power cables, and/or electrical power sources (e.g., generators, etc.).

E. The Contractor shall be responsible for coordinating electrical and water services, and shall pay for these services for the duration of the project (if applicable).

F. The Contractor shall assist the Consultant by providing necessary tools and equipment (e.g., coveralls, ladders, extension cords, lighting, etc.) for the Consultant to perform project monitoring activities (e.g., final visual inspection(s), etc.). The Consultant reserves the right to reject such items that are deemed unsafe and/or do not function properly, and may request items be replaced with adequate replacements. The work areas must be safe to enter/occupy by the Consultant at all times.

G. HEPA-Vacuum Equipment, of suitable size and capacities for the project, shall have HEPA filter(s) capable of trapping and retaining at least 99.97% of all mono-dispersed particles of 0.3 micrometers in diameter or larger.

PART 3 - EXECUTION

3.01 PRE-CONSTRUCTION MEETING

A. A pre-construction meeting may be scheduled prior to the start of Work. The Contractor must attend this meeting (as required by the Owner); the assigned Asbestos Competent Person must also attend this meeting.

B. The Contractor shall present a detailed project schedule and project submittals at the pre-construction meeting. Variations, amendments, and corrections to the presented schedule will be discussed, and the Owner and the Consultant will inform the Contractor of any scheduling adjustments for this project.

C. Following the pre-construction meeting, the Contractor shall submit a revised schedule (if needed) no later than one week after the meeting.

D. The Contractor shall complete Form 1 and Form 1A as required for the duration of the project to document proper work practices (see attached at end of Section).

3.02 WORK AREA PREPARATION

A. The Contractor shall demarcate the work area by restricting access to authorized personnel.

B. The Contractor shall expose the pipe in a manner that will minimize the risk of making it friable or releasing asbestos dust into the environment.

C. The Contractor shall start by exposing the ACP with minimal disturbance by excavating no closer than 6 inches of the pipe.

D. The Contractor shall carefully uncover the remainder of the soil surrounding the pipe by hand or shovel.

E. The Contractor shall stockpile the excavated soil adjacent to the excavation in accordance with OSHA set-back requirements.

F. The Contractor's Asbestos Competent Person shall assess the ACP to determine if it is damaged, cracked, or broken.

G. Regardless of ACP assessment, the Contractor shall place 6-mil think poly sheeting under the ACP to prevent soil contamination. Note that if the excavation is filled with water, the placement of poly sheeting is not required.

3.03 ACP REMOVAL PROCEDURES – INTACT ACP

A. The Contractor shall have an Asbestos Competent Person on the Site at all times to ensure proper work practices are followed throughout the project.

B. If a Consultant is retained for pre-abatement services, abatement work shall not commence until authorized by the Consultant.

C. Prior to the removal of ACM, the Contractor shall ensure that work area preparations have been conducted in accordance with applicable Subsections of this Section.

D. The Contractor shall adequately wet the full-length of exposed ACP with amended water before and during removal.

E. The Contractor shall separate ACP at the nearest coupling (i.e., bell or compression fitting), if possible.

F. The Contractor shall prepare the excavation for saw cutting of intact ACP. Note that is breakage or cutting of the ACP is required, the procedure in Damaged ACP section (3.05) shall be followed.

G. Slide the ACP apart at the joints (no saw cutting) or use other methods that do not cause the pipe to break, become friable, or otherwise create the potential to release asbestos fibers.

H. Wrap the wet ACP in two layers of 6-mil poly sheeting, seal with duct tape, and label in accordance with the requirements set forth in this Section. Note this work can be done in the excavation or adjacent to the excavated area.

I. Sealed disposal containers, and all equipment used in the work area, shall be included in the cleanup and shall be removed from work area at an appropriate time in the cleaning sequence.

J. At any time during asbestos removal, should the Consultant suspect contamination of areas outside the work area(s), they shall cause all abatement work to stop until the Contractor takes the necessary steps to decontaminate these areas and eliminate the causes of such contamination. Unprotected individuals shall be prohibited from entering suspected contaminated areas until air sampling and visual inspections verify decontamination.

K. After completion of the initial final cleaning procedure, including removal of all containers, but prior to backfilling, a final visual inspection shall be conducted by the Contractor's Asbestos Competent Person or Asbestos Project Monitor. The final visual inspection shall verify that ACP and residual debris has been removed from the excavation.

3.04 ACP REMOVAL PROCEDURES – DAMAGED ACP

A. If visible ACP debris is observed in the excavation, the Contractor shall remove it with (minimum) one inch of underlying soil and disposed of as ACWM.

   1. Soil must be containerized in 6-mil poly bags or drums lined with 6-mil poly. Bulk loading of soil is not permitted without MassDEP approval of a non-traditional asbestos work practice.

B. Adequately wet full-length of exposed ACP with amended water before and during removal.

C. Saw cutting of ACP shall only be conducted with approved wet-cutting equipment (ICS or Wachs Guillotine).

D. Wrap wet ACP in two layers of 6-mil poly sheeting, seal with duct tape, and label.

E. Manage wrapped ACP, poly, and any other material contaminated with visible asbestos debris as ACWM.

F. Sealed disposal containers, and all equipment used in the work area, shall be included in the cleanup and shall be removed from work area at an appropriate time in the daily cleaning sequence.

G. At any time during asbestos removal, should the Consultant suspect contamination of areas outside the work area(s), they shall cause all abatement work to stop until the Contractor takes the necessary steps to decontaminate these areas and eliminate the causes of such contamination. Unprotected individuals shall be prohibited from entering suspected contaminated areas until air sampling and visual inspections verify decontamination.

H. After completion of the initial final cleaning procedure, including removal of all containers, but prior to backfilling, a final visual inspection shall be conducted by the Contractor's Asbestos Competent Person or Asbestos Project Monitor. The final visual inspection shall verify that ACP and residual debris has been removed from the excavation.

3.05 SOIL CONTAINING ACP FRAGMENTS – BEFORE LOADING

A. If soil is observed to contain ACP fragments before it is loaded, the Contractor shall containerize the soil in 6-mil poly bags or lined drums and handle it as ACWM in accordance with this Section.

B. If containerization is not feasible, the Contractor shall contact the Consultant and City of Framingham Project Manager to contact MassDEP to approve an NTWP to address the bulk loading of contaminated soil.

3.06 SOIL CONTAINING ACP FRAGMENTS – AFTER LOADING

A. If soil is observed to contain ACP fragments after it has been loaded onto the Contractor's vehicle the Contractor shall immediately cease loading operations.

B. The Contractor shall secure the vehicle and the soil shall be covered with poly sheeting or tarpaulin.

C. The Contractor's Asbestos Competent Person shall inform the Consultant and City of Framingham Project Manager.

D. The Contractor shall transport the soil to a designated TASL (at the direction of the City of Framingham Project Manager).

E. The Contractor shall transfer the soil onto poly sheeting or tarpaulin in a manner that does not raise dust.

F. The Contractor shall cover the soil stockpile with poly sheeting or tarpaulin.

G. The Contractor shall ensure the soil is disposed of as directed by the Consultant and City of Framingham Project Manager.

3.07 SOIL CONTAINING ACP – OFF-SITE STOCKPILE LOCATION

A. If soil is observed to contain ACP fragments after it has been transferred to the Contractor's off-site temporary location, the Contractor shall cease operations impacting the stockpile.

B. The Contractor shall cover the stockpile with poly sheeting or tarpaulin.

C. The Contractor shall contact the Consultant and City of Framingham Project Manager.

D. The Contractor shall proceed at the direction of the Consultant and City of Framingham Project Manager.

3.08 ASBESTOS CEMENT PIPE TAPPING

A. The Contractor shall place 6-mil poly sheeting under the ACP to prevent soil contamination.

B. The Contractor shall adequately wet the ACP with amended water before tapping to avoid creating airborne dust.

C. The Contractor shall dispose of any material contaminated with visible asbestos debris as ACWM.

3.09 DEWATERING

A. If water is observed within an excavation, the Contractor shall try to pump the water out of the excavation to expose the ACP.

B. The Contractor shall assess the condition of the ACP and determine whether it is intact or deteriorated.

C. If ACP is intact the Contractor shall pump the water from the excavation and discharge it to the closest storm drain.

D. If the ACP is broken or deteriorated, the Contractor shall pass the standing water (after initial pump and discharge to storm drain) through a 5-micron filter before being discharged to the closest storm drain. The filter shall then be disposed of as ACWM.

3.10 CONSULTANT'S/CONTRACTOR'S INSPECTION RESPONSIBILITIES

A. The Contractor's Asbestos Competent Person or the Owner's Resident Engineer may conduct inspections throughout the progress of the removal project. Inspections will be conducted to document the removal work progress, as well as the Contractor's procedures and practices.

B. The Contractor's Asbestos Competent Person or the Owner's Resident Engineer may perform the following inspections during abatement activities:

1. Pre-Commencement Inspection: If required or retained for this service, pre-commencement inspections shall be performed at the time requested by the Contractor. The Consultant shall be informed 24 hours prior to the time the inspection is needed. If deficiencies are noted during the pre-commencement inspection, the Contractor shall perform the necessary adjustments to obtain compliance.
2. Work Area Inspections: If required or retained for this service, work area inspections shall be conducted on a daily basis, at the discretion of the Consultant. During the work inspections, the Consultant's Asbestos Project Monitor shall observe the Contractor's removal procedures, assess project progress, and, if deficiencies are noted, inform the Contractor of specific remedial activities.

C. The Contractor's Asbestos Competent Person or the Owner's Resident Engineer shall perform the following inspections after removal activities are completed:

D. Final Visual Inspection: When removal is complete, the Contractor's Asbestos Competent Person or the Owner's Resident Engineer will conduct a final visual inspection inside each excavation. The Consultant shall be informed 24 hours prior to the time that the inspection is needed. After completion of the initial final cleaning procedure, including removal of all containers, but prior to backfilling, a final visual inspection shall be conducted by the Contractor's Asbestos Competent Person. The final visual inspection shall verify that ACP and residual debris has been removed from the excavation. If residual debris is identified during the final visual inspector, the Contractor shall re-clean the excavation to meet the "no visible, suspect dust or debris" standard.

3.11 TEMPORARY ASBESTOS STORAGE LOCATION (TASL)

A. All ACP waste material shall be transported to the Owner's Temporary Asbestos Storage Location (TASL)(229 Arthur Street, Framingham, MA).

B. The Contractor shall provide a locked, covered, and labeled dumpster for the storage of ACP waste.

C. The Owner shall provide space at the TASL for the Contractor's waste dumpster.

D. The Owner will provide access to the secured TASL through the Resident Engineer.

E. The Contractor shall be responsible for the 30-day disposal deadline and final transport to an approved disposal facility.

3.12 ASBESTOS DISPOSAL

A. ACM and/or ACWM disposal (including supplies, rags, disposable clothing, respirator filter cartridges, etc.) shall be completed in accordance with MassDEP and EPA regulations. Waste receptacles (bags, drums, etc.) shall be labeled in accordance with the most current OSHA regulations (Title 29 CFR, Parts 1910.1001 and 1926.1101) and contain the following:

DANGER
CONTAINS ASBESTOS FIBERS
MAY CAUSE CANCER
CAUSES DAMAGE TO LUNGS
DO NOT BREATHE DUST
AVOID CREATING DUST

B. Disposal site approvals shall be obtained and accepted prior to the start of asbestos removal activities.

C. A copy of the signed disposal authorization shall be provided to the Owner, Consultant, and any required federal, state, or local agencies.

D. Copies of all Waste Shipment Records (WSR) shall be provided to the Owner no later than 35 calendar days from when the waste was removed from the Site for inclusion in the project file. The Contractor shall document the specific amount of waste on each WSR, portion/location of the Site building it was generated from, and the type of waste. Upon receipt of the ACM waste, the landfill operator shall sign the WSR so the quantity of asbestos debris leaving the Site and arriving at the landfill is documented for the Owner.

E. All wash water and shower water shall be collected and filtered through a five-micron filter before discharge to a sanitary sewer with prior appropriate permitting or publicly-owned treatment works (POTW) approval. Alternately, wash and shower water can be used to moisten ACWM.

F. All ACWM shall be transported in covered sealed vans, boxes, or dumpsters which are physically isolated from the driver by an airtight barrier. All vehicles must be properly-licensed to meet Commonwealth of Massachusetts and United State Department of Transportation (DOT) requirements.

G. Any vehicles used to store or transport ACWM will either be removed from the Site at night, or securely locked and posted to prevent disturbance.

H. Any incident and/or accident that may result in spilling or exposure of ACWM outside the containment, on and off the property, and all related issues shall be the sole responsibility of the Contractor.

END OF SECTION

SECTION 02080

SOIL AND WASTE MANAGEMENT

PART 1 - GENERAL

1.01 QUALIFICATIONS

A. The Contractor shall demonstrate the necessary skills, experience, training, and qualifications to conduct the work as specified herein.

B. The Contractor shall possess all required licenses, insurance, permits and trained employees to properly execute the work as specified herein.

C. All personnel involved in the transportation of waste from the site shall have the required skills, experience, training, and qualifications including, but not limited to, Department of Transportation (DOT) and Occupational Safety and Health Administration (OSHA) training.

1.02 EXISTING CONDITIONS

A. The following documents are available for review and appended to these Technical Specifications.

1. Hazardous Materials Survey, dated April 23, 2019, including any sample results from preliminary investigations

B. The Contractor is obligated to review existing environmental assessment reports and manage the soil and groundwater in accordance with applicable state and federal regulations.

1.03 DEFINITIONS

A. Asphalt, Brick and Concrete (ABC): Asphalt, Brick and Concrete material that is waste from construction or found in fill material during excavation. ABC material found in clean, reusable fill may be reused onsite to the greatest extent possible. All excess ABC generated during construction shall be disposed of offsite at an appropriate, licensed facility that will accept ABC waste.

B. Area of Excavation: For the purposes of reusing soil on-site, the *area of excavation* is considered to be the approximate area in which the soil was removed provided that area is consistent in soil strata, color, texture, geotechnical properties and has substantially similar visual and olfactory characteristics. Soil returned to the *area of excavation* shall be returned to approximately the same horizontal and vertical location from which it originated provided that it is not placed in an area that differs substantially in physical or chemical characteristics as can be observed and

measured during excavation. Soil returned to the area of excavation shall be placed and compacted as specified in the Contract Specifications.

C. Authorized Excavation: Earth Excavation or "Excavation" consists of removal of materials encountered to the elevations and widths indicated in the Contract Drawings, Specifications, or as directed by the Engineer.

D. Background: (see Section 1.3.W.1)

E. Bill of Lading (BOL): A document signed by a waste transporter or the transporter's representative and issued to a waste generator that evidences the receipt of waste to a specified disposal facility or location. BOL is typically utilized as accompanying documentation during transport of Regulated soils. Soils subject to management under 310 CMR 40.0035.

F. Competent Person: for purposes of this Specification, the term shall mean one who is capable of identifying existing and predictable hazards in the surroundings or working conditions which are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them [29 CFR 1926.32(f)].

G. Containerized Waste (as defined in 310 CMR 40.0000) means discarded oil and/or hazardous material at a site in drums, tanks, engineered impoundments, or other fabricated containers, including, without limitation:

1. discarded oil and/or hazardous material that was generated at a site as a results of manufacturing industrial, commercial or other process-related activities, and
2. discarded oil and/or hazardous material discovered, managed, generated, or accumulated as part of a response action.

H. Contaminated Media:

1. Contaminated Debris (as defined in 310 CMR 40.0000) means any debris that contains oil and/or hazardous material associated with a release for which notification is required by 310 CMR 40.0300 and 40.1600.
2. Contaminated Groundwater (as defined in 310 CMR 40.0000) means groundwater containing oil and/or hazardous material at concentrations equal to or greater than a release notification threshold established by 310 CMR 40.0300 and 40.1600.
3. Contaminated Sediments (as defined in 310 CMR 40.0000) means sediments containing oil and/or hazardous material associated with a release for which notification is required by 310 CMR 40.0300 and 40.1600.
4. Contaminated Soil (as defined in 310 CMR 40.0000) means soil containing oil and/or hazardous material associated with a release for which notification is required by 310 CMR 40.0300 and 40.1600.
5. Contaminated Surface Water (as defined in 310 CMR 40.0000) means surface water containing oil and/or hazardous material associated with a release for which notification is required under 310 CMR 40.0300 and 40.1600.

I. Debris (as defined in 310 CMR 40.0000) means solid material that is a manufactured object, plant or animal matter that is intended for disposal or is otherwise no longer serving its intended use. The term shall include demolition and construction waste, hay, vegetation, and other organic and inorganic absorbent materials used to contain or absorb releases of oil and/or hazardous material. The term shall not include:

1. any material for which a specific treatment standard is provided in 40 CFR Part 268, Subpart D; or
2. process residuals such as smelter slag and residues from the treatment of waste, wastewater, sludges or air emission residues.

J. Demolition and Construction Waste (as defined in 310 CMR 40.0000) means any waste materials and rubble resulting from the construction, remodeling, repair or demolition of buildings, pavement, roads or other structures. Demolition and construction waste includes, but is not limited to, concrete, bricks, lumber, masonry, road paving materials, rebar and plaster.

K. Disposal shall mean safe and legal reuse, recycling, or disposal off the site in a manner as required to comply with all applicable statutes and regulations.

L. Hazardous Material as defined 310 CMR 40.0006.

M. Hazardous Waste:

1. Hazardous waste as defined 310 CMR 40.0006; or
2. Hazardous waste as defined in 40 CFR 261.3.
3. A waste, or combination of wastes, that, because of its quantity, concentration, or physical, chemical, or infectious characteristics may:
   a. Cause or significantly contribute to an increase in mortality or cause or significantly contribute to an increase in a serious irreversible or incapacitating reversible illness; or
   b. Pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, disposed of, or otherwise managed.

N. Licensed Site Professional and LSP (as defined in 310 CMR 40.0006) each means a hazardous waste site cleanup professional, as defined in M.G.L. c.21A, §19, holding a valid license issued by the Board of Registration of Hazardous Waste Site Cleanup Professionals pursuant to M.G.L. c.21A, §§19 through 19J.

O. Liquid Waste: materials generated onsite due to work performed and are waste or excess including but not limited to collected groundwater, collected stormwater, non-aqueous phase liquids, Contractor-supplied fuels and fluids, and drummed liquids.

P. Material Shipping Record (MSR): A document signed by a waste transporter or the transporter's representative and issued to an acceptance facility that evidences that receipt of unregulated soils or waste to a specified disposal facility or location. For the shipment of contaminated soil, urban fill, and dredge materials not subject to management under 310 CMR 40.0035.

Q. Massachusetts Contingency Plan or MCP: 310 CMR 40.0000

R. Natural Soils: Natural soil is defined for the purposes of the Contract as unconsolidated sand, gravel, silt and clay, and the organic material which has become part of the unconsolidated soil matrix. For this section only, soil may include broken and fragmented rock.

S. Peat: A substance of vegetable origin, consisting of roots and fibers, moss, etc., in various stages of decomposition, and found, as a kind of turf or bog. Peat shall be considered natural soil when it is encountered in small amounts (layers 1-foot (304.8 mm) or less in thickness) and when it is impractical to separate the peat from the natural soil or urban fill strata. Otherwise, peat shall be considered a distinctive stratum.

T. Regulated Soil: Soils requiring management in accordance with 310 CMR 40.0000, and require BOL to document transport. (see Section 1.3.W.3)

U. Remediation Waste: as defined in 310 CMR 40.0006 means any Uncontainerized Waste, Contaminated Media, and/or Contaminated Debris that is managed pursuant to 10 CMR 40.0030. Remediation Waste does not include Containerized Waste.

V. Solid Waste (Waste): materials generated on site due to work performed and are waste or excess, including but not limited to asphalt, brick and concrete (ABC) waste, demolition waste, decontamination waste, dredging spoils (dewatered), metal waste, plaster/drywall, plastic waste, rock, rubber waste, sediment, tar waste, trash, vegetation debris, wood waste.

W. Soil Classification Categories: Unless specifically stated otherwise, terms used in this specification are as defined in the Massachusetts Contingency Plan (MCP), 310 CMR 40.0006. The following definitions and soil classifications apply to these specifications:

1. Background or Unregulated Soil: Any fill or natural soil material which meets the regulatory definition of "background" as defined in 310 CMR 40.0006 may be reused as common fill/ordinary borrow provided it also meets the physical requirements as specified herein and as specified in Section 02210 - Earth Excavation, Backfill, Fill and Grading. Suitable soil which does not have any evidence of contamination may be reused within the area of excavation without first performing laboratory analyses. For record keeping purposes soil/fill that meet the definition of background, shall be transported under a Material Shipping Record (MSR). Background means those levels of oil and hazardous material that would exist in the absence of an MCP Disposal Site, including both Natural Background and Anthropogenic Background. Background soil may also be re-

used off-site without restriction provided it is reused in an area where background concentrations are equal to or greater than the site-specific background determined at the off-site location in accordance with DEP Policy WSC#13-500 Similar Soils Provision Guidance (or most recent update). The Contractor is responsible for determining the background levels at the point of excavation. It is also the Contractor's responsibility to identify one or more disposal facilities/locations with background levels appropriate to receive the material to be disposed or reused. It is the Contractor's responsibility to determine these background levels in advance so as to comply with 310 CMR 40.0032(3)(b) and so as not to delay or adversely affect construction operations.

2. Impacted: Any soil or fill material which contains oil or hazardous materials (OHM) at concentrations greater than background levels but less than release notification thresholds established by 310 CMR 40.0300 and 40.1600. Impacted soil may be reused in the area of excavation or as fill provided it is reused in an area of equal or greater contamination and meets the physical requirements as specified herein and as specified in Section 02210 - Earth Excavation, Backfill, Fill and Grading. Impacted soils requiring off-site transportation and disposal/reuse shall be transported using a Material Shipping Record (MSR).
3. Contaminated or Regulated Soils: Any soil or fill material which contains oil or hazardous materials at concentrations equal to or greater than a release notification threshold established by 310 CMR 40.0300 and 40.1600, except where the presence of the material is consistent with the regulatory definition of "background" as defined in 310 CMR 40.0006.

   Any soils which contain either petroleum or chemical odor or visual indications of oil or hazardous materials shall be handled as potentially contaminated soils. Soil/fill that may be contaminated shall be set aside by the Contractor for assessment by the Contractor's environmental professional (LSP) in a secure manner to prevent exposure to humans and the environment and in accordance with 310 CMR 40.0036. Soil/fill that is staged and characterized can be reused within the area of excavation or elsewhere on site provided the material has been tested and has equal or less contamination than the point where it is to be reused and it is not reused beneath a permanent structure such as a building foundation. Any excavated soil/fill material not reused within the area of excavation must be characterized prior to off-site reuse/disposal. After analytical results are available, soil/fill shall be handled in accordance with the type and degree of contamination (if any) present in the soil/fill, and recommendations of the Contractor's LSP.

   Contaminated soil that cannot be reused on site shall be reused off-site, recycled, or disposed as a solid waste at an appropriately permitted facility unless it also meets the regulatory definition of hazardous waste as defined in 40 CFR Part 261 or contains detectable asbestos. Contaminated soils requiring off-site transportation and reuse/disposal or recycling shall be transported using a Material Shipping Record (MSR) or Bill of Lading (BOL), as appropriate. Subcategories of Contaminated soil are defined as follows:

   a. Unlined Landfill Material: Soils that meet all applicable criteria (i.e., COMM 97-001 and/or facility-specific permit requirements) for off-site reuse as daily cover, intermediate cover, or pre-cap contouring material at in-state unlined

landfills. Note: per COMM 97-001, sediments may not be re-used as Unlined Landfill Material.

b. Lined Landfill Material: Soils that meet all applicable criteria (i.e., COMM 97-001 and/or facility-specific permit requirements) for off-site reuse as daily cover, intermediate cover, or pre-cap contouring material at in-state lined landfills.

c. Asphalt Batch Plant Material: Soils that meet all applicable criteria for recycling at an asphalt batching plant and/or the specific licensing requirements for the proposed recycling facility. Soil that does not meet the applicable COMM 97-001 criteria for Unlined or Lined Landfill Material that is characterized by the following: TPH concentrations in excess of 5,000 milligrams per kilogram (mg/kg), or total SVOC concentrations in excess of 100 mg/kg, or total non-chlorinated VOC concentrations in excess of 10 mg/kg, and total lead concentrations below 3,000 mg/kg and TCLP metal concentrations below applicable hazardous levels. Material classified as Asphalt Batch Plant Material shall be excavated and transported to an asphalt batch plant for recycling. This material cannot be used as daily cover at or disposed of at a Massachusetts Unlined or Lined Landfill.

d. Out-of-State Non-Hazardous: Soilsthat contain concentrations of contaminants that exceed in-state lined and unlined landfill reuse criteria as well as asphalt batch plant acceptance criteria, but meet the criteria for regional thermal treatment facilities or out-of-state recycling facilities, and are not classified as a Resource Conservation and Recovery Act (RCRA) Hazardous Waste.

4. Hazardous Waste: A waste, or combination of wastes, that, because of its quantity, concentration, or physical, chemical, or infectious characteristics may cause or significantly contribute to an increase in mortality or cause or significantly contribute to an increase in a serious irreversible or incapacitating reversible illness; or pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, disposed of, or otherwise managed. Also included within the definition of hazardous waste is hazardous waste as defined 310 CMR 40.0006 and 40.CFR 261.3. Hazardous waste as defined in 40 CFR 261.3 is a solid waste that exhibits any of the characteristics of hazardous waste in excess of regulation levels presented in 40 CFR 261, subpart C and/or that is listed in 40 CFR 261, subpart D; that is a mixture of solid and hazardous waste; or that is derived from a listed waste. Subcategories of Class C soils shall be as follows:

   a. Post-treatment Non-Hazardous: Soils classified as hazardous waste that have been treated on-site to reduce the toxicity characteristic (e.g., for TCLP lead).

   b. Hazardous: Material determined to contain "listed" or "characteristic" hazardous waste constituents which cannot be readily treated on-site. This material must be transported to an out-of-state approved RCRA Subtitle C hazardous waste disposal or treatment facility under a Uniform Hazardous Waste Manifest.

X. Special Waste: Any waste that is determined not to be a hazardous waste pursuant to 310 CMR 30.000 and that exists in such quantity or in such chemical or physical state, or any combination thereof, so that particular management controls are

required to prevent an adverse impact from the collection, transport, transfer, storage, processing, treatment or disposal of the waste. Asbestos and PCB-contaminated soils/fill are examples of special waste categories. Also refer to Specification Section 02076 – Asbestos-Cement Pipe Removal.

Y. Transportation Documentation or Shipping documentation means the document used to identify and accompany soil or waste during transport such as a Material Shipping Record (MSR), Bill of Lading (BOL), or Uniform Hazardous Waste Manifest. Also referred to as a shipping record.

Z. Unauthorized Over Excavation: Consists of removal of materials beyond indicated elevations and width limits indicated in the Contract Documents without direction of the Engineer. Over-excavation material handling, transportation and disposal, backfilling and compaction shall be at the Contractor's expense. Over-excavations shall be backfilled and compacted as specified for excavations of the same class, unless otherwise directed by the Engineer.

AA. Unauthorized Excavation: Consists of removal of materials beyond indicated sub-grade elevations or Contract-defined limits as shown in the Contract documents without specific direction of the Engineer. Unauthorized excavation, handling material, transportation and disposal, backfilling and compaction shall be at the Contractor's expense. Unauthorized excavations shall be backfilled and compacted as specified for excavations of the same class, unless otherwise directed by the Engineer.

BB. Unknown Materials: Any material, that is not readily identifiable as nonhazardous waste, and which has not been previously characterized or encountered during site investigation activities. The Unknown Material classification is to be used in the event that an unexpected, unusual material is encountered for which special handling procedures shall be required in order to handle the material safely. Such wastes include but are not limited to:

1. Unlabelled drums or containers containing material which is not readily identifiable as a non-hazardous substance.
2. Any material, which varies significantly from material previously observed on site and which cannot be readily identified as a nonhazardous.
3. Waste material of unusual color or odor or material with indications of hazardous levels (e.g. exceeding OSHA permissible exposure limits) of contaminants as evidenced on an organic vapor monitor or other similar instrument.

The Owner reserves the right to apply generator knowledge to classify and profile the material as a previously encountered waste or as a known waste. In the event that a material is encountered which the Contractor is uncertain as to its nature, the Owner or their representative shall assess the material with the Contractor and inform the Contractor as to the nature of the material (known or unknown).

CC. Unregulated Soil: (see Section 1.3.W.1)

DD. Urban Fill: Fill, also known as urban, or miscellaneous fill, is defined as a mixture of soil and other materials which have been located in the area through man-made processes primarily for the purpose of grading, backfilling or filling in low areas. Material commonly associated with urban fill includes, but are not limited to; coal, glass, brick, ash, wood fragments and other similar granular materials. Urban fill shall not include boulders, ledge, consolidated rock, asphalt, concrete, railroad timbers, rail, cobblestones or any other abandoned building materials.

EE. Waste Manifests: the hazardous waste shipping/transportation documentation required to ship all hazardous waste and subject to provisions in 49 CFR 172 Subpart C.

1.04 DESCRIPTION OF WORK

A. General

1. This Section includes furnishing all labor, equipment, materials, and incidentals required to perform all operations in connection with the handling and disposition, stockpiling, transport, in-project reuse and/or off-site reuse or disposal of excess excavated materials resulting from the construction operations as specified. In-project reuse shall be defined as material that is reused within the Project, such as approved use of excavated soils as backfill into the excavation trench after installation of new utilities.
2. This Section includes proper handling and management of waste materials, including, but not limited to, construction debris, building demolition, municipal waste, boulders, regulated and unregulated soils, ash, rubble, asphalt, brick and concrete (ABC), asbestos containing material, asbestos cement pipe (Section 02076), hazardous materials and empty or crushed drums and/or drum parts.
3. 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.
4. All work shall be conducted in compliance with Contractor-prepared plans as specified in Paragraph 1.7 Submittals of this Section.
5. Implementation of the submitted HASP and other applicable includes establishing work zones (e.g., support zone, contamination reduction zone, exclusion zone), preparing a decontamination pad(s) and staging area(s), performing the appropriate environmental monitoring, training and medical monitoring of personnel, coordinating waste disposal and waste characterization as needed, etc.
6. The Contractor shall develop, implement, maintain, supervise, and be responsible for all soil management practices during the course of this contract. An OSHA Competent Person, with demonstrated experience in clean and contaminated soil and hazardous waste handling (e.g. L.S.P.), shall be present during all excavation, backfilling, field screening, segregating, handling, and characterization of all soils excavated in the course of completing this contract to ensure that soil is managed in accordance with applicable laws, regulations, and this Section.
7. Demobilizing the site, including, but not limited to, removing and disposing of excess or waste soils, rock, solid waste, demolition waste, construction-related equipment and materials used for personnel and equipment decontamination and related waste such as personal protective equipment (PPE), decontamination

water/solids, temporary covers, and wash-water storage tanks; disconnection of temporary utilities; and final clean-up to pre-construction conditions.

8. The Contractor is responsible for being aware of potential hazards at the site and reviewing all existing information which provides evidence of contamination within the limit of the work.

B. Soil and Waste Management

1. This Section describes the general parameters and requirements for testing (including field screening and laboratory chemical analysis), excavation, handling, storage, tracking, transport, and in-project reuse or off-site reuse/disposal of soils.
2. In the course of the work, it may be necessary to excavate and handle potentially contaminated soil or hazardous material. The soil or hazardous materials management practices specified herein apply to all soil and/or hazardous materials excavated during the course of this Contract. Contaminated soils and hazardous materials/hazardous waste shall be managed in accordance with 310 CMR 40.0000 and 310 CMR 30.000.
3. The Contractor shall segregate soils during excavation and stockpiling to avoid mixing soils (i.e. topsoil, fill and natural soils shall be segregated, in addition to regulated, unregulated soils, etc.).
4. Characterization of soil, and unknown material for disposal/off-site reuse purposes; field screening and soil management/segregation; temporary storage/staging; and characterization (as may be necessary for unknown materials and/or for compliance with receiving facility requirements); and disposal and/or off-site reuse of excavated soil and waste material. All laboratory chemical analyses conducted shall utilize currently accepted U.S. EPA and applicable state agency analytical protocols and procedures.
5. The Contractor shall characterize all excavated and stockpiled soil and fill material prior to off-site reuse or disposal. Characterization requirements may vary depending on the source/location of the excavated soil/fill, the site selected to receive soil suitable for off-site reuse, or the disposal facility permits and policies. The Contractor is responsible for final waste characterization and shall determine if any additional waste characterization is required at no additional cost to the Owner.
6. Providing and constructing a secure soil staging area sized to adequately segregate soils in accordance with the conditions specified without impeding construction-related activities. The Contractor is to use existing information and obtain additional information as may be needed to minimize the need for a staging area. If a staging area is required to characterize unknown or excess material for any reason, the Contractor is responsible for locating, selecting, preparing and securing the area.
7. Excavated soil/fill that is contaminated or may be suspected as contaminated or containing hazardous materials shall be stockpiled and covered prior to characterization and off-site reuse or disposal. Since individual disposal facilities will have different permit conditions and specific pre-characterization data requirements the Contractor is responsible for final soil characterization prior to transport and disposal. The Contractor is hereby made aware that for the purposes

of disposal, final soil characterization is the responsibility of the Contractor and costs for securing a staging area and conducting waste characterization shall be incorporated into the Contractor's bid price for construction.

8. During construction activities, excavated soil/fill waste shall be field-screened by the Contractor and either loaded directly for off-site disposal (provided the excavated material is consistent with previously conducted investigations) or stockpiled in a soil/fill waste staging area located by the Contractor and approved by the Owner and Engineer. Stockpiles of soils shall be minimized to reduce the amount of waste material stored onsite. Stockpiled materials that are to be disposed of shall remain onsite for only as long as it would reasonably take to characterize (if not done in advance), load and transport offsite to an approved disposal facility. Soils that are to be re-used as fill material shall be stockpiled and maintained per Section 3.4 Staging Areas.
9. Soil suspected of having the characteristics of a hazardous waste or of containing a listed hazardous waste shall not be removed from the excavation except at the direction of the Engineer.
10. Soil/fill waste shall not be staged within 100 feet (30.5 meters) of a reservoir, wetland or Area of Critical Environmental Concern or in a 100-year floodplain. Soil/fill waste shall not be staged in the work area over night. Contaminated material requiring additional waste characterization due to waste disposal facility requirements or in order to assess unknown materials, shall be staged securely pending analytical sampling and characterization by the Contractor.
11. The Contractor shall reuse excavated soil at the point of origin to the maximum degree possible. Soil/fill which cannot be reused immediately at the point of origin shall either have been pre-characterized for off-site reuse or disposal by the Contractor and directly loaded for off-site transport (provided the excavated soil/fill is consistent in visual, olfactory and field screening characteristics with subsurface investigation conducted prior to construction pursuant to the MCP) or it shall be staged at a location determined and secured by the Contractor pending analytical characterization.
12. Excavating soil, fill and waste containing potential asbestos-containing material (e.g., transite board) shall conform to SECTION 02076 ASBESTOS CEMENT PIPE REMOVAL. No off-site staging of asbestos materials or asbestos containing soils shall be allowed except at the direction of the Owner.
13. Removing characterized on-site materials for off-site re-use or disposal.
14. Placing and grading of certified clean fill (including fill from on-site which is determined to be suitable for re-use). The Contractor is to maximize the in-project reuse of on-site materials by using soil suitable for such reuse prior to importing material on site.
15. In the event that a previously uncharacterized, unknown material is encountered the Contractor shall manage the material separately and will temporarily stage the material pending characterization as specified herein.
16. All Investigation Derived Wastes are the property and responsibility of the Contractor and are to be disposed of by the Contractor under a Uniform Hazardous Waste Manifest, Material Shipping Record or by a Bill of Lading, as appropriate. The parties understand and agree that any consultant or sub-consultant (at any tier) is not, and has no responsibility as, a generator, treater, storer, transporter, or disposer of hazardous or toxic substances found or

identified at the project site, and that the Contractor agrees to assume responsibility for and indemnify and hold any consultant or sub-consultant (at any tier) harmless from the foregoing.

C. Groundwater Management

1. Management of contaminated groundwater: If groundwater potentially impacted by oil and/or hazardous material (OHM), based on visual or olfactory evidence, is encountered in the course of the work, construction dewatering and discharge permits and groundwater treatment may be necessary depending upon the discharge method(s) and/or location(s) utilized by the Contractor. The Owner and Engineer shall be notified by the Contactor if groundwater potentially impacted by OHM is identified. REFER TO SECTION 02140 DEWATERING.

1.05 RELATED WORK

A. Section 01025 - Measurement and Payment
B. Section 01069 - Health and Safety Requirements
C. Section 01560 - Temporary Controls
D. Section 02140 – Dewatering
E. Section 02200 - Earth Excavation, Backfill, Fill and Grading

1.06 REFERENCES

A. All work at the site must be performed in accordance with all applicable federal, state, and local regulations, permits and licenses. Comply with applicable requirements of the following standards and those referenced in this Section. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.

B. OSHA regulations (including, but not limited to, 29 CFR 1910.1000, 29 CFR 1926, and CFR 1910.120), 40-hour Occupational Safety and Health Administration (OSHA) training (plus 8-hour refresher training) and all other applicable state and federal regulations regarding health and safety requirements;

C. The applicable parts of the Code of Federal Regulation (CFR) Title 40: Protection of Environment, pertaining to the Comprehensive Environmental Response and Liability Act (CERCLA) and the Superfund Amendments and Reauthorization Act (SARA), RCRA, and the National Emission Standards for Hazardous Air Pollutants (NESHAPS) as regulated by the U.S. Environmental Protection Agency (U.S. EPA);

D. Massachusetts Site Assignment Regulations for Solid Waste Facility Regulations 310 CMR 16.000.

E. Massachusetts Solid Waste Management Facility Regulations 310 CMR 19.00.

F. State regulations specified in the Massachusetts Contingency Plan (MCP) (310 CMR 40.0000), and Massachusetts General Law 21E - Massachusetts Oil and

Hazardous Materials Release Prevention and Response Act, and applicable Massachusetts Department of Environmental Protection (MassDEP) guidelines and policies;

1. Massachusetts Department of Environmental Protection, Bureau of Waste Site Cleanup Policy No. WSC-94-400 entitled "Interim Remediation Waste Management Policy for Petroleum Contaminated Soils," dated April 21, 1994.
2. Massachusetts Department of Environmental Protection Bureau of Waste Prevention Policy No. COMM-97-001 entitled "Reuse and Disposal of Contaminated Soils at Massachusetts Landfills," dated August 15, 1997.
3. Massachusetts Department of Environmental Protection, Bureau of Waste Prevention Policy No. WSC#-13-500 "Similar Soils Provision Guidance," dated September 4, 2013.
4. Massachusetts Department of Environmental Protection, Policy #COMM-15-01 "Interim Policy on the Re-Use of Soil for Large Reclamation Projects," dated August 28, 2015.
5. MassDEP Technical Update. Background Levels of Polycyclic Aromatic Hydrocarbons and Metals in Soil (2002);

G. Department of Transportation (DOT) regulations 49 CFR, and state transportation licenses and permits;

H. NIOSH/OSHA/USCG/EPA: "Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities" October 1985, DHHS (NIOSH). Publ. No. 85-1 15;

I. Department of Transportation training;

J. U.S. Army Corps of Engineers 404 permit;

K. Contractor's license;

L. National Pollutant Discharge Elimination System (NPDES) Notice of Intent (NOI) to discharge and associated general permits;

M. Massachusetts Water Resources Authority pretreatment and construction dewatering requirements and permits;

N. Excavation and/or grading permits;

O. Special use permits;

P. Special waste haulers certificate;

Q. Massachusetts Wetlands Protection Act and associated Order of Conditions;

R. City of Framingham wetland regulations and bylaws; and The Contractor's Soil and Waste Management Plan (SWMP) and Health and Safety Plan to protect the workers and the public.

1.07 SUBMITTALS

A. The Contractor shall prepare a Work Plan that generally describes the work to be performed under 02080 Part 3 (Execution). The work plan shall include, but not be limited to detailing the submittal and implementation of the following:
   1. Soil and Waste Management Plan;
      a. Dust, Vapor and Odor Control Plan;
      b. Air Monitoring Plan;
      c. Equipment and Personnel Decontamination Plan
   2. Site-Specific Health and Safety Plan (See Section 01069);
   3. Dewatering Plan (See Section 02140);
   4. Stormwater Handling Plan;
   5. Spill and Discharge Control Plan;
   6. Asbestos Management Plan (See Section 02076); and
   7. MCP required reports as necessary (RAM, URAM, status reports, closure reports).

   The Soil and Waste Management Plan (S/WMP) shall be submitted at least three weeks prior to the beginning of any intrusive work at the site. All other required plans shall be submitted to the Owner or Engineer and/or their representative for review and approval at least two weeks prior to beginning any intrusive work at the site. Plans shall be consolidated provided the requirements of each plan are fully incorporated therein.

B. Soil and Waste Management Plan (S/WMP): The S/WMP shall outline measures for sampling, field screening, laboratory analysis, and disposal/ off-site reuse of soils and wastes generated at the Project site. At a minimum, this plan shall address the following:
   1. Methods, procedures, and equipment used for excavating, characterizing, segregating, reusing/backfilling, loading, and transporting contaminated soil/solid waste materials encountered during excavation operations;
   2. A list of all transporters and receiving facilities, complete with license numbers, permit numbers (as appropriate), contact person, and address and telephone number that the Contractor utilizes for soil management and waste disposal. In addition, a copy of a memorandum of understanding between the Contractor and each disposal facility shall be attached to the Soil and Waste Management Plan. The memorandum of understanding shall detail that the disposal facility agrees to accept a specified quantity of waste as characterized in the contract specifications and detail what if any restrictions may apply. The Contractor shall provide copies of the permits held by each disposal facility which the Contractor plans to use to dispose of non-hazardous solid waste, hazardous waste, PCB-impacted waste and asbestos-containing waste. The transporters shall have adequate financial insurance and liability insurance mechanisms to handle any accidents, and associated third-party compensation;
   3. A summary of the history of compliance actions for each receiving facility proposed to be used by the Contractor. The compliance history shall include a

comprehensive list of any state or federal citations, notices of non-compliance, consent decrees or violations relative to the management of waste (including remediation waste) at the facility. The Owner reserves the right to reject any facility on the basis of poor compliance history;

4. If hazardous wastes are to be transported, Contractor shall have or obtain a valid EPA identification number to transport hazardous materials and any other permits or licenses as required by federal, state and local laws, regulations, ordinances and procedures.
5. Procedures for securing the staging area, controlling dust and soil/solid waste migration, preventing damage to uncontaminated areas via contaminant migration and for decontaminating vehicles and personnel exiting the staging area;
6. The means and methods for decontaminating all equipment and personnel, including provisions for installing an equipment decontamination pad if required or specified.
7. Means, methods and equipment for locating and protecting stockpiles.
8. Methods and procedures for identifying stockpiled material (e.g., labeling, marking containers) and procedures for identification and tracking;
9. Methods, procedures, and equipment used for obtaining the necessary information needed to satisfy the off-site reuse/disposal facility requirements specified herein and/or by the facility;
10. Methods, procedures, and equipment proposed for assessing and handling Unknown Materials. The S/WMP shall indicate which laboratory(ies) the Contractor shall utilize for chemical analysis of soil, groundwater and unknown materials.
    a. An Unknown Materials information sheet shall be developed as part of the Contractor's S/WMP, upon which the Contractor shall record information such as container type, size, and condition; and, any identifying characteristics of the unknown material. The format of the information sheet shall be as accepted by the Owner and/or its representatives;
    b. The Contractor’s plan for notifying the Owner and Engineer in the event that an unknown material as defined in this specification is encountered. The plan shall include the phone numbers and names of the Owner’s representative(s) that the Contractor would contact in such an event.
11. Provisions for separation of incompatible materials and segregation of different class of soil;
12. Procedures for consolidating (i.e., bulking) compatible materials for disposal.
13. Procedures for dewatering as well as handling, characterization, storing, treating and disposing of groundwater due to dewatering. Refer to Section 02140 – Dewatering.
14. Procedures for diverting and handling site stormwater. This would include handling, treatment and discharge of storm water.
15. Provisions, procedures and equipment used for control of dust, vapor and odor; including measures to control objectionable dust, vapors, and odors originating from the site (Section 3.7). This shall describe procedures to minimize the creation of dust, and the control of objectionable vapors and odors originating from the site.
16. Provisions, procedures and equipment used to monitor air at the site (Section 3.6). This shall include site specific monitoring for potential hazards in the air;

including the proposed instrument(s) to be used, the expected hazards (e.g., dust, VOCs), the monitoring frequency, the monitoring locations, and the reporting procedures.

C. Soil Management/Tracking Documentation: Prior to off-site disposal or reuse, the Contractor shall provide to the Engineer a letter from the disposal facility indicating that the facility has reviewed the available data relative to the soil/solid waste to be delivered and agrees that the soil/solid waste meets their acceptance criteria. The letter shall be signed by a duly authorized representative of the receiving facility.

Within the time constraints established in state and/or Federal laws and regulations, the Contractor shall submit to appropriate authority(ies) and the Owner, as applicable, Uniform Hazardous Waste Manifests, Material Shipping Records, and/or Bills of Lading (collectively referred to as transportation documentation) for all soils, rock, ACB, asbestos pipe, asbestos containing materials (ACM), hazardous waste and waste disposed or reused of off-site utilizing such documents. Copies of all transportation documentation and all other documents used to track and/or permit off-site transportation of soils or wastes shall be submitted to the Owner and Engineer within ten (10) days of shipment. All transportation documentation shall be signed by the transporter and receiving/disposal facility. The Contractor is responsible for preparation of all transportation documentation, manifests, Bills of Lading, Material Shipping Records, and all other related documents completely and accurately prior to submitting them to the Owner and/or its representative for generator and LSP signatures. The Contractor shall be responsible for submitting to the Owner's LSP all information necessary for preparation of LSP opinion letters to disposal facilities and coordinating disposal documentation with all parties. The Owner's LSP and the Owner shall the sign any MassDEP Bill of Lading forms where required only after the Contractor has provided the information required for preparation of electronic MassDEP forms. The Contractor shall be responsible for paying for any and all fines associated with inaccurate, incorrect, or improperly completed transportation documentation and all other related documents, including fines resulting from late or untimely submittals.

D. Stormwater Handling Plan

1. The Stormwater handling plan shall provide provisions to ensure compliance with Section 3.10, other portions of the Contract Documents, and all applicable local, state and federal permits.

E. Quality Control Plan

1. The Contractor shall prepare a Quality Control plan for the development, implementation, and maintenance of a quality control system to ensure that the specified quality is achieved for all materials and work performed.

F. Spill and Discharge Control Plan (SDCP): The SDCP shall provide contingency measures and reporting responsibilities for potential uncontrolled spills and discharges of contaminated and/or hazardous materials, including, but not limited to: fuels, oils, contaminated groundwater, granular solid waste, leachate, decontamination water, sewage, and other on-site waste materials. In addition to the

above listed items, the SDCP shall specifically contain: procedures for containing dry and liquid spills; absorbent material available on site; storage of spilled materials; governmental reporting (i.e., notification) procedures; decontamination procedures; discharges of sanitary or combined sewers into storm drains either by flow handling/bypassing or accidental or unintentional discharge; and procedures for protecting wetlands and surrounding public and private property.

The Spill and Discharge Plan shall indicate the location and quantity of the materials to be staged on site and the basis for the quantities (i.e. indicate the vessel which will be on site containing the greatest volume of oil or hazardous materials). No fuel or oil tanks or drums may be temporarily staged on site unless they are stored within a secondary containment system. Fuel deliveries shall be performed in a designated area which has either secondary spill containment or an impervious surface with absorbent berms located around the point of fuel delivery. The Spill and Discharge Plan shall indicate the location of the fueling area and the nature of secondary containment which the Contractor intends on utilizing.

1. Notification Procedures: The Contractor shall prepare in advance of work activities a notification list, complete with phone numbers, addresses, and contact names for all parties to be notified in the event of a spill. This list shall be posted on-site at all times and shall include:
   a. Owner's designated representatives;
   b. Owner;
   c. Fire Department;
   d. Engineer;
   e. Massachusetts Department of Environmental Protection (as required per 310 CMR 40.0000). The Owner shall be notified immediately of an uncontrolled spill or discharge. If human health or the environment are potentially threatened, the Contractor shall take immediate action to abate the conditions and notify emergency personnel;
   f. Appropriate emergency personnel.

2. Spill Incident Report(s): In the event of an uncontrolled spill or discharge, a written report detailing each uncontrolled spill or discharge shall include, at a minimum, the cause and resolution of incident, outside agencies involved, and date and time of occurrence. The report shall be submitted to the Owner within 48 hours of the incident. The Contractor shall document all spills on the as-built Drawings and submit the Drawings to the Owner at project completion. The Contractor shall be responsible for remediating any spills or releases of oil or hazardous materials as a result of the Contractor's activities. The site shall be remediated to pre-release conditions at no additional cost to the Owner.

G. Medical surveillance records, OSHA 40-hour training forms, accident forms, and all other documentation requirements of the Contractor's safety and health program for personnel working on the site (who are subject to exposure to potentially contaminated soil) shall be up-to-date and kept on file at the site. The Contractor shall provide documentation of employee status upon request of the Engineer and/or their representative.

PART 2 - PRODUCTS

2.01 DUST CONTROL

A. Dust suppression may be achieved by applying controlled amounts of water or dust suppression chemicals to the project site, and through covering of soil stockpiles, etc. Dust suppression shall be carried out in accordance with the approved SWMP.

2.02 SPILL CONTROL

A. At a minimum, the Contractor shall maintain on-site absorbent pads, booms and absorbent materials in sufficient quantity to address a release of fuel oil, hydraulic oil or other OHM that the Contractor intends to use or store on site, including fuel oil and hydraulic oil that is used within earth moving equipment. The quantity of spill containment materials maintained on site shall be sufficient to respond to a catastrophic release from the vessel containing the greatest quantity of oil or hazardous material on-site.

2.03 SOIL MANAGEMENT/TRACKING DOCUMENTATION

2.03.1 Provide completed Bills of Lading (BOLs), Material Shipping Records (MSRs), manifests, certificates of disposal, weight slips and all other documentation relative to disposal, reuse, treatment, recycling or other means of off-site use of soil and waste materials.

2.03.2 Provide appropriate equipment and materials to protect and delineate stockpiles as necessary.

PART 3 - EXECUTION

3.01 GENERAL

A. All work in this section will be performed in accordance with the Contractor's Work Plan, S/WMP, Site-Specific HASP and any other site specific plans/reports that have been approved by the Owner and Engineer.

B. The primary concern of the Contractor in the excavating, handling, sampling, bulking, and on-site storage of soil/solid waste and/or drummed material (if encountered) will be to protect the health and safety of the site workers, the public, and the environment.

C. The Contractor shall keep a copy of the Health and Safety Plan (HASP) on site during all operations and shall conduct daily health and safety meetings. Failure to keep a copy of the HASP on-site, or any other breach of the Contractor's Plan, may be cause for stopping work at the cost of the Contractor. Delays caused by the Contractor's failure to comply with the health and safety regulations or any health and safety plan shall not entitle the Contractor to recover any additional costs or time lost. The Contractor shall not be allowed to resume activities until corrective measures are accepted by the Engineer and/or their representative and implemented.

D. The Contractor shall reuse geotechnically suitable excavated material prior to using imported backfill to reduce the volume of material to be reused/disposed off-site.

Imported backfill shall be used only as accepted by the Engineer. Urban fill soils and roadway base/subbase shall be re-used to the maximum extent before reusing naturally occurring soils. If off-site disposal is required, natural soils shall be preferentially disposed or reused. Contamination shall not be exacerbated as a result work activities.

3.02 SOIL/FILL WASTE CHARACTERIZATION

A. Soil and fill material shall be classified based on the criteria established in the accepted SWMP.

1. Initial Characterization of Soil/Fill Waste Material: A summary of existing conditions and investigation findings performed by the Engineer during design, including a summary of analytical results, shall be available to the Contractor.
2. The Contractor shall review all the existing conditions information supplied by others. The Contractor shall use the information and shall either perform independent sampling and characterization of soil/fill waste strata to be encountered during construction in advance of excavation such that excavated soil or wastes can be segregated and directly transported to an appropriate facility or the Contractor shall make the necessary arrangements to secure a staging area(s) suitable for storing soil stockpiles or wastes pending analyses, at no additional cost to the Owner. No staging of asbestos materials or asbestos containing soils shall be allowed except at the direction of the Owner. The Contractor shall identify known or suspected areas where hazardous materials may be encountered, including but not limited to asbestos, PCB, lead-based paint.
3. Soil shall be preliminarily segregated based on the Soil Classification Categories detailed in Section 1., except as indicated below.
    a. Potential Asbestos Containing Material (PACM). If soil/fill waste suspected of containing asbestos is encountered during excavation, the Contractor shall immediately contact the Engineer to discuss the nature and extent of the PACM and to assess potential hazards and appropriate handling procedures. Prior to handling and removing the PACM, MassDEP shall be contacted for approval. Discovery and management of PACM shall be documented in the S/WMP. Evidence of PACM includes but is not limited to the presence of suspect asbestos-containing building debris such as cementitious (transite) piping, vinyl floor tiling, roofing paper or paper-like insulation materials or any other suspect asbestos containing material observed in the soil/fill waste. Following MassDEP approval, such soil/fill waste shall be segregated and stockpiled pending confirmatory analysis to determine appropriate disposal requirements.
    b. Unknown Material. If unknown material is encountered during excavation, the Contractor shall immediately contact the Owner and Owner's representative to discuss the nature and extent of the unknown material and to assess potential hazards and appropriate handling procedures. Prior to handling and removing the unknown material from the excavation area, the Contractor and Owner and/or its representatives, shall visually assess the material and its potential hazards. Drums shall be assessed to determine whether they are leaking, corroded, pitted, bulging (evidence of reactive waste), crushed,

empty, filled-in-place. Crushed, empty, and/or skeletal parts of drums shall be handled as solid waste, as specified. Note any evidence of staining or olfactory indications of contamination. The Contractor shall record any identification or markings on the drummed material(s). Discovery and management of unknown materials shall be documented as required in the SWMP.

4. Final Waste Characterization: Final waste characterization shall be the responsibility of the Contractor. The Contractor shall be responsible for determining the characterization requirements of each disposal facility in advance to facilitate timely off-site removal and to adequately estimate the disposal costs. The Contractor shall perform additional segregation based on disposal requirements. Disposal or off-site reuse of the material shall depend on sampling and characterization analytical results. At the request of the Engineer or Owner, the Contractor shall provide a split sample. The Contractor shall perform or observe all sampling and shall provide notice in advance to the Engineer so that the Engineer may observe the sampling procedure.

B. Stockpiles within the staging area shall be sampled and characterized within a timely manner so as not to impede construction activities or preclude the reuse of soil/fill on site. If soil/fill cannot be reused on site due to the Contractor's delay in sampling material, the Contractor shall dispose of the soil/fill at no additional cost to the Owner including the additional cost of imported fill material used in its place to meet project requirements.

3.03 SOIL/SOLIDS WASTE MANAGEMENT

A. The Contractor shall reuse, recycle or dispose of all excess soil and wastes resulting from excavation activities in accordance with federal, state and local regulations and these specifications, as well as all other state laws through which the waste material is being transported.

B. The Contractor shall obtain receipts of disposal for disposed wastes as applicable.

C. The Contractor shall be responsible for preparing and keeping in proper order all waste manifests, BOLs, MSRs, and shall designate one person who shall be made available to sign all transportation documentation. The Contractor shall be responsible for obtaining the generator's signature and all other signatures required for the proper completion of the transportation documentation. The Contractor shall allow a minimum of five (5) working days from the date of the submittal for any documents requiring the signature of the Owner and/or the LSP. The transportation documentation shall document the handling of the excess excavated soil or waste from the time it is generated until the time it is properly reused or disposed.

D. The Contractor shall be responsible for obtaining all federal, state, and local permits and variances to allow transport of materials and wastes on public roadways.

E. Transportation of wastes shall be in compliance with any relevant federal, state and local requirements, and such as to assure that waste material is not released during transit.

F. Soil and fill material that is managed under a Utility-Related Abatement Measure (URAM) Plan pursuant to the MCP, and which is staged off-site may be re-used within fourteen (14) calendar days of excavation. Any material which is suitable for re-use as ordinary borrow, based on analytical results and could have been placed on site, but was not, due to Contractor delay (i.e. analytical results were not available within 10 days following excavation) will be disposed in accordance with the applicable regulations by the Contractor at no cost to the Owner.

G. Soil and fill material that is managed under a URAM Plan pursuant to the MCP, which is staged off-site and which is determined at the staging area to be characteristically hazardous may be treated (stabilized) within the "Area of Contamination" only and must be reused with 14 days or disposed of within ninety (90) calendar days of excavation. No treatment may occur at the staging area. Pursuant to the MCP and RCRA, hazardous Remediation Waste (e.g., Hazardous soils) shall be removed from the site within 90 days. All other Remediation Waste (e.g., Contaminated soils) shall be removed within 120 days unless exceptions identified at 310 CMR 40.0031(7) apply.

H. Contaminated and Hazardous excavated soils shall be completely covered and secured in accordance with this. Soils exhibiting evidence of potential contamination including but not limited to odors and/or staining shall be covered prior to characterization and off-site reuse or disposal.

I. The Contractor shall be responsible to inform the Owner if hazardous waste disposal will not be performed within 90 days of hazardous waste characterization. This notification shall take place a minimum of 30 days prior to the 90-day deadline. No hazardous waste stockpiled at the site shall remain on site more than 90 days after it is characterized. In accordance with 310 CMR 40.0031, all other Remediation Waste shall not remain on site or temporary off-site storage location more than 120 days from initial date of generation.

J. Transporters of solid wastes that include, but are not limited to, contaminated soil/fill (including OHM-contaminated soil), construction and demolition debris non-hazardous laboratory wastes, bottles, tires, metal parts, tree stumps, brush, and grass cuttings will utilize trucks or dumpsters specifically designed to ensure that material, dust, or liquid is not released in transit. No truck shall be allowed to exit the site until all free liquids are drained from soil being transported off-site. Moisture content of the soil/waste shall be reduced by the Contractor, to or below the maximum acceptance limits required by the disposal facility. Material shall be covered at all times. The vehicle in which the waste is transported shall be driven directly to the intended destination without any stops or detours in between, except those necessary in response to road conditions, vehicle service needs, or emergencies. Discharge or release of material during transport shall be immediately reported to the Owner.

Transporters shall clean up any discharge that occurs in transit, at the Contractor's expense.

K. Manifesting of solid waste shall be required and shall include at a minimum: vehicle identification; date of loading and disposal; tonnage, as measured at the disposal site; and signature of the Owner and/or its representative, transporter, and disposal facility's representative. Transportation of the wastes shall be accompanied by the appropriate manifests such as a MassDEP Bill of Lading, as required in the Code of Massachusetts Regulations (CMR) 310 CMR 40.0030, a Material Shipping Record or by a Uniform Hazardous Waste Manifest. The original shall be returned to the Owner, and/or their representative, within ten (10) working days of disposal.

3.04 STAGING AREAS AND STOCKPILING

A. Prior to disposal, the Contractor shall maintain segregated excess excavated soil and waste stockpiles in conformance with all applicable federal, state and local waste disposal regulations. No staging of asbestos materials or asbestos containing soils shall be allowed except at the direction of the Owner.

B. The Contractor's staging area shall be large enough to store equipment, materials and all stockpiled soils. The Contractor shall protect the staging area from contamination due to excavating, handling, storing and disposing of hazardous materials.

C. Stockpiled soils determined to be Contaminated or Hazardous, as described herein, shall be securely covered at the close of each day and continuously when not being added to or otherwise being handled by the Contractor. Stockpiles shall also be covered at times as directed by the Engineer.

D. Stockpiles of soils that are known or suspected to be hazardous within the soil staging areas shall be placed on a 20-mil HDPE liner/filter fabric and bermed to minimize the potential for contamination release. Each soil category shall be staged in separate areas with barriers to keep different soil types from mixing. Waste characterized as RCRA hazardous waste or other Hazardous soils shall not be stored on site for a period greater than ninety (90) days. All other waste, including Unregulated or Contaminated soils, must be disposed of off-site within 120 days of excavation. At the end of each working day, contaminated soils will be covered with 10-mil polyethylene to minimize the potential for release of contaminants.

E. Covers on stockpiles of soils that are known or suspected to be hazardous shall be secured with tires, ropes, anchors or equivalent material. The cover system shall be capable of resisting actual wind gusts at the site, with a minimum wind capacity of 40 miles per hour. The stockpile covers shall be installed and secured at the end of each working day and at all times when earthwork is not taking place on site. Stockpile covers shall be immediately re-covered should wind forces expose any of the excavated materials. Failure to adequately protect the stockpiles may result in non-payment.

F. Stockpiles are to be segregated based on visual, olfactory, and field screening results. Similar material may be stockpiled together. Each stockpile must be clearly separated from adjacent stockpiles.

G. Stockpiles will be clearly designated by a sign post or marker which can be cross-referenced with samples collected from the pile for characterization purposes. The signs/markers are not to be moved, except by authorized personnel and not until the soil is ready to be either reused on site or loaded for off-site disposal.

H. Unknown, potentially hazardous soils/debris and drummed materials encountered during the project shall be located in a separate bermed location. The Contractor's Soil and Waste Management Plan shall provide construction details of the dimensions and protective measures proposed for the staging area(s). The construction details and protective measures are subject to the approval of the Owner and/or its representatives. The Contractor shall select the area to facilitate handling of the material and to minimize interference with other ongoing construction activities. The Owner or Engineer must agree with the location prior to construction. In the event that excavation is conducted near storm water drainage basins or inlet manholes, the Contractor must protect the drainage structures with filter fabric or provide similar protection to prevent sediment loading and migration of contaminated soils and sediments.

I. If the soil storage area consists of an unimproved or otherwise pervious surface, and soil to be stockpiled is known or suspected to be contaminated, the Contractor shall install a lining of 6-mil (or greater) polyethylene, to protect the soil from the potential of intermixing with existing subsurface soils.

J. Stockpiles shall be no greater than 250 cubic yards in volume. If space constraints, etc. make it infeasible to maintain separate stockpiles of soils to 250 cubic yards, the Waste Management Plan shall include a map with the locations of the composite samples for each stockpile shall be provided to the Resident Engineer prior to the submittal of the samples to the off-site analytical laboratory. This will allow any portion of the stockpile, which came back as contaminated soil to be properly segregated and managed separately.

K. Stockpiles shall be established and maintained as per EPA requirements under the Construction General Permit Section 2.1.2.4. Requirements include the following.
   1. Locate the piles outside of any natural buffers and physically separated from other storm water controls;
   2. Protect from contact with storm water (including run-on) using a temporary perimeter sediment barrier;
   3. For all soils, provide cover or appropriate temporary stabilization to minimize sediment discharge and to contain and securely protect from wind; nevertheless, the Contractor shall provide cover for any stockpiles containing contaminated soils as specified herein;
   4. Do not hose down or sweep soil or sediment accumulated on pavement or other impervious surfaces into any storm water conveyance (unless connected to a

sediment basin, sediment trap, or similarly effective control), storm drain inlet, or surface water; and

5. Unless infeasible, contain and securely protect from wind.

3.05 HAZARDOUS WASTES

A. Transporters of hazardous wastes shall be in conformance with Code of Federal Regulations (CFR) 40 CFR, Part 171, all other federal laws and regulations and 310 CMR 30.400, and all other state laws through whose boundaries the waste material is being transported. The transporter shall provide copies of its EPA identification number, Massachusetts transporter's license, and proof of driver training in transporting hazardous waste.

B. The disposal site shall be in conformance with 40 CFR, Part 264 and relevant laws of the state in which the facility is located. The Contractor shall provide copies of the disposal facility's EPA and state treatment and disposal permit.

C. Manifesting of hazardous wastes shall be in conformance with 40 CFR, Part 264, Subpart E, 310 CMR 30.310 and 310 CMR 30.405.

D. Actual quantities which are subject to unit rates shall be tabulated by the Contractor and verified by the Engineer on a daily basis. The Contractor shall not be reimbursed for unit rate work performed without the prior approval of quantities by the Engineer.

3.06 EQUIPMENT AND PERSONNEL DECONTAMINATION

A. Equipment and personnel decontamination facilities shall be provided by the Contractor when hazardous materials are expected to be encountered and handled onsite. Equipment and personnel decontamination area(s), conforming with the Contractor's HASP and these Specifications, will be constructed in such a manner to protect existing site surfaces, materials, and structures from contamination. The equipment decontamination area(s) will be sized adequately to provide for the decontamination of the largest piece of equipment to be decontaminated. Filter fabric will be placed over an impermeable liner to protect the liner from rips, punctures, or tears from traffic and heavy equipment.

B. The Contractor shall establish a site-specific decontamination protocol and decontamination areas for personnel and equipment utilized at the subject site. Personnel and equipment decontamination shall be conducted in compliance with the HASP.

C. The decontamination protocol shall include (i) the means, methods, and materials for the proposed decontamination procedures; (ii) the procedures employed to contain and store the wash or rinse liquids/sludges; (iii) procedures used to sample, analyze, and characterize the contaminated wash or rinse liquids/sludges; (iv) procedures to contain or clean contaminated equipment and PPE; and (v) the

procedures for handling and disposing of solid wastes generated from site decontamination activities. All sample analysis shall be completed by a certified laboratory. The Contractor shall be responsible for the cost of this analytical work. The Contractor shall submit a copy of the analytical results and laboratory certifications to the Owner for review prior to proceeding with disposal. The Contractor shall be responsible to properly manifest and dispose of all residual wastes generated from on-site activities in conformance with federal, state, and local environmental and transportation regulations. The Contractor shall be responsible for the manifests and procedures to be used to package and dispose of contaminated solid wastes, wash, or rinse liquids at an EPA or state-approved treatment or disposal facility. The Contractor shall be responsible for any releases from site or decontamination activities due to its work, and will remediate any release for which the Contractor is responsible to pre-existing conditions at the Contractor's expense.

D. Provisions for collecting decontamination water will be incorporated into the maintenance of the decontamination pad and will include placing an impermeable liner over a sloped surface such that water is directed, if necessary, into an area for subsequent pumping to 55-gallon drums or other appropriate tankage. Following completion of the work, the wash water shall be characterized by the Contractor and disposed off-site, in accordance with federal, state, and local regulations.

3.07 ENVIRONMENTAL FIELD MONITORING / DUST CONTROL

A. The air monitoring program is to be designed to protect public health and the environment from the potential generation of dust and contaminant release during work. All personnel shall be made aware of the potential hazards and be informed of air monitoring information by the Contractor.

B. Dust control measures shall be implemented by the Contractor during all soil handling operations, loading and transport of waste material from the site in accordance with the Contractor's Dust Control Plan.

C. Air monitoring shall occur when excavating or handling soils that are known or suspected to be hazardous or contain OHM. The Contractor shall keep accurate documentation of all air monitoring, which will be made available to the Engineer or Owner upon request.

1. At a minimum, the air monitoring shall include daily monitoring and documentation of one upwind, and two downwind conditions during periods of activity on the site and when there is a potential for dust being generated on the site. The air monitoring information including air monitoring in the vicinity of all site activities shall also be utilized for establishing levels of personal protection measures in the Contractor's Site Specific Health and Safety Plan. The Contractor shall submit his/her air quality monitoring program for review and approval prior to commencement of site activities.
2. Air monitoring shall include headspace analyses in a jar or plastic bag performed using a portable photoionization detector or other appropriate instrument for the anticipated conditions. The Contractor shall be responsible for properly

calibrating the instrument each day and recording the calibration in a daily log which shall include the following information:

a. Name of device or instrument calibrated.
b. Date of calibration.
c. Results of calibration.
d. Name of person performing the calibration.
e. Identification of the calibration gas.

3. The Contractor is responsible for providing fully charged instrument(s) at the start of each work day.
4. When applicable, field screening samples shall be taken from numerous locations within the excavation. Samples shall be taken from any area that appears to be visibly contaminated or where an odor is noted.

D. If there are indications of contamination, the frequency of air monitoring will be determined by an Industrial Hygienist or competent environmental health professional. The Contractor's Site Health and Safety Officer and Superintendent will be responsible for assuring that monitoring is conducted in an appropriate manner, and that work practices, engineering controls and/or Personal Protective Equipment are proper for the conditions.

E. Dust shall be controlled during excavation of soil/fill waste material to limit potential spread of contaminants and potential exposure of contaminants to workers and the public.

F. During construction, real-time dust monitoring shall be conducted under windy and/or excessively dry working conditions or when directed by the Engineer. The monitoring shall consist of total dust testing using MIE, INC. MINIRAM PDM-3 DUST MONITORS, or like instruments. The total dust criteria at the site shall conform to the requirements of the HASP. Should fugitive dust quantities exceed 20 percent of the ambient level or action levels indicated within the HASP, the Contractor shall perform additional measures to reduce the total dust concentrations.

G. Nuisance dust levels shall be reduced by pre-wetting the surface soils and by establishing and maintaining clean access roads. The Contractor's Dust, Vapor, and Odor Control Plan shall describe the procedures and materials to minimize dust. At a minimum, the Contractor shall provide clean water, free from salt, oil, and other deleterious materials.

H. Areas of exposed earth to be excavated shall be lightly sprayed with water before excavation if there is potential for nuisance dust generation. Additional water spray may be utilized only when any indication of excessive dust is observed. To the extent feasible, the Contractor shall minimize the use of water within the limits of excavation.

I. Unimproved access roads shall be sprayed with water on a regular basis to minimize the generation of dust.

J. All containers temporarily storing waste material shall be covered at all times except as necessary to place waste material into the container. The Contractor shall monitor

the covers daily to ensure the covers are in place and effectively eliminating the generation of dust and make appropriate notes in the site log.

3.08 VAPOR AND ODOR CONTROL

A. The Contractor shall provide the materials and labor to control objectionable vapors and odor in accordance with the Contractor's SWMP. The Contractor shall limit the exposure area and shall cover the exposure area with synthetic reusable covers, lime, foam suppressants, or other methods to reduce off-site odors to acceptable levels. The Contractor shall not use soil suitable for on-site reuse as cover to control vapor and odors.

3.09 BULKING

A. Following characterization and compatibility testing of waste material, the Contractor shall place compatible materials into common containers to reduce transport and disposal costs, when practicable and with the approval of the Engineer. In addition, materials that are improperly contained shall be transferred into the appropriate containers. Drums and containers used during this project shall meet the appropriate DOT, OSHA, and U.S. EPA regulations for the materials contained. The Contractor shall describe the bulking procedures in the Soil and Waste Management Plan.

3.10 CONTAMINATED LIQUIDS

A. The Contractor shall collect and properly dispose of contaminated liquids and other liquids generated or encountered on site during construction. Contaminated liquid sources include decontamination water, and drummed liquids encountered during excavation. The Contractor shall be responsible for treating and disposing of contaminated groundwater as required by applicable regulations and SECTION 02140 DEWATERING.

3.11 STORMWATER CONTROL

A. The Contractor shall protect all work from erosion while onsite. The Contractor shall divert all stormwater from work areas that may contain oil or hazardous materials (OHM). Stormwater that may contact OHM, polychlorinated biphenyls (PCBs), lead, asbestos or other types of impacted soil shall be collected within the immediate area of the contact, treated (as determined by sampling and testing) and disposed of in accordance with all local, state and federal regulations. Stormwater that is collected, stored onsite and sampled shall be tested and characterized for determining proper transportation, disposal and/or discharge in accordance with SECTION 02140 DEWATERING.

3.12 BACKFILLING AND COMPACTION

A. Excavated areas shall be backfilled with appropriate backfill material (including excavated material suitable for reuse and, when necessary, imported off-site material)

as specified in SECTION 02200 - EARTH EXCAVATION, BACKFILL, FILL AND GRADING.

3.13 CLEANUP

A. During the course of the work, the Contractor shall keep the Site and his operations clean and neat at all times. He shall dispose of all residue resulting from the site clearing operations; and at the conclusion for the day's Work, he shall remove and haul away any surplus materials, lumber, equipment, temporary structures, and any other refuse remaining from the site clearing operations and shall leave the entire site in a neat and orderly condition.

Sample Waste Stream Disposal Summary Table

Material Type	Pre-Approval by Receiving Facility	Testing/ Analysis	Transportation Documentation	Proposed Receiving Facility/Facilities
Asbestos Containing Material (ACM)	Required	Not required	WSR	
Asbestos Cement Pipe (ACP)	Required	Not required	WSR	
Unregulated Soils	Required	Required	MSR	
Impacted/Regulated Soils	Required	Required	BOL	
Hazardous materials	Required	Required	HWSM	
Catch basin cleanings	Required	Required	WSR	
Street Sweepings	Required	Not required	WSR	
Contaminated Dewatering liquids	Required	Required	BOL	
Uncontaminated dewatering liquids	Required	Not required	Not required	
Sanitary Sewerage	Not required	Not required	Not required	
Asphalt, Brick and Concrete Material (ABC)	Not required	Not required	MSR, MassDEP notification form if crushed	
Construction Debris	Not required	Not required	Not required	
Vegetation	Not required	Not required	Not required	
Municipal Solid Waste	Not required	Not required	Not required	
Recyclable Materials	Not required	Not required	Not required	

END OF SECTION 02080

SECTION 02082

ASBESTOS ABATEMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Remove, encapsulate, or otherwise abate asbestos-containing materials (ACM) as described herein.

B. Dispose ACM in accordance with governing laws and regulations; pay costs of permits and disposal.

1.2 CODES, REGULATIONS, AND STANDARDS - ASBESTOS ABATEMENT

A. Federal Requirements that govern asbestos abatement work or hauling and disposal of asbestos waste materials include but are not limited to the following specifications:

1. OSHA: U.S. Department of Labor, Occupational Safety and Health Administration, (OSHA), including but not limited to the following regulations:

a. Respiratory Protection: Title 29, Part 1910, Section 134 of the Code of Federal Regulations

b. Construction Industry: Title 29, Part 1926, of the Code of Federal Regulations

c. Hazard Communication: Title 29, Part 1910, Section 1200 of the Code of Federal Regulations

2. DOT: U.S. Department of Transportation, including but not limited to the following regulation:

a. Hazardous Substances: Title 29, Part 171 and 172 of the Code of Federal Regulations

3. EPA: U.S. Environmental Protection Agency (EPA), including but not limited to the following regulations:

a. Asbestos Abatement Projects; Worker Protection Rule: Title 40 Part 763, Sub-part G of the Code of Federal Regulations

b. Asbestos Hazard Emergency Response Act (AHERA) Regulation: Asbestos Containing Materials in Schools Final Rule & Notice, Title 40, Part 763, Sub-part E of the Code of Federal Regulations

c. Training Requirements of (AHERA) Regulation: Asbestos Containing Materials in Schools Final Rule & Notice, Title 40, Part 763, Sub-part E, Appendix C of the Code of Federal Regulations

d. National Emission Standard for Hazardous Air Pollutants (NESHAPS): National Emission Standard for Asbestos, Title 40, Part 61, Sub-part A, and Sub-part M (Revised Sub-part B) of the Code of Federal Regulations

B. State Requirements that govern asbestos abatement work or hauling and disposal of asbestos waste materials include but are not limited to the following:

1. Department of Environmental Protection (310 CMR 7.00)

2. Department of Labor and Work Force Development (453 CMR 6.00—The Removal, Containment or Encapsulations of Asbestos

3. Department of Transportation

C. Local requirements that govern asbestos abatement work or hauling and disposal of asbestos waste materials include but are not limited to the following:

1. Local Department of Health (project notification)

2. Local Police Department (project notification)

3. Local Fire Department (project notification)

D. Standards:

1. General Applicability of Standards: Except to the extent that more explicit or more stringent requirements are written directly into the Contract Documents, all applicable standards have the same force and effect (and are made a part of the Contract Documents by reference) as if copied directly into the Contract Documents, or as if published copies are bound herewith.

2. Contractor Responsibility: The Contractor shall assume full responsibility and liability for the compliance with all standards pertaining to work practices, hauling, disposal, and protection of workers, visitors to the site, and persons occupying areas adjacent to the site.

3. Standards that apply to asbestos abatement work or hauling and disposal of asbestos waste materials include but are not limited to the following ANSI and ASTM standards.

4. American National Standards Institute (ANSI), 1430 Broadway, New York, New York 10018, (212) 354-3300
   a. Fundamentals Governing the Design and Operation of Local Exhaust Systems, Publication Z9.2-79

   b. Practices for Respiratory Protection Publication Z88.2-80

5. American Society for Testing and Materials (ASTM), 1916 Race Street, Philadelphia, PA 19103, (215) 299-5400

a. Safety and Health Requirements Relating to Occupational Exposure to Asbestos, ASTM E 849-82

E. EPA Guidance Documents: listed below are documents discussing asbestos abatement work or hauling and disposal of asbestos waste materials, and are for the Contractor's information only. These documents do not describe the work and are not a part of the work of this contract. EPA maintains an information number (800) 334-8571, and publications can be ordered from (800) 424-9065 (554-1404 in Washington, DC):

1. *Guidance for Controlling Asbestos-Containing Materials in Buildings* (Purple Book) EPA 560/5-85-024.

2. *Asbestos in Buildings: Guidance for Service and Maintenance Personnel*. EPA 560/5-85-018.

3. *Asbestos Waste Management Guidance*. EPA 530-SW-85-007.

4. *A Guide to Respiratory Protection for the Asbestos Abatement Industry*. EPA-560-OPTS-86-001.

F. Posting and Filing of Regulations: Post all notices required by applicable federal, state, and local regulations. Maintain two (2) copies of applicable federal, state, and local regulations and standard. Maintain one copy of each at job site. Keep on file in Contractor's office one copy of each.

1.3 DEFINITIONS AND STANDARDS - ASBESTOS ABATEMENT

A. Air Lock: A mechanism or system of enclosures within the decontamination facility that does not allow air movement between clean and contaminated areas. Consists of a three-foot wide space between each of the sections of the decontamination chamber segregated by full polyethylene barriers.

B. Amended Water: Water to which a surfactant has been added to decrease the surface tension to 35 or less dynes.

C. Asbestos: The asbestiform varieties of serpentine (Chrysotile), riebeckite (crocidolite), cummingtonite-grunerite, anthophyllite, and actinolite-tremolite. For purposes of determining respiratory and worker protection both the asbestiform and non-asbestiform varieties of the above minerals and any of these materials that have been chemically treated and/or altered shall be considered as asbestos.

D. Asbestos-Containing Material (ACM): Any material containing more than 1% by weight of asbestos of any type or mixture of types.

E. Asbestos-Containing Waste Material: Any material that is or is suspected of being or any material contaminated with an asbestos-containing material that is to be removed from a work area for disposal.

F. Asbestos debris: Pieces of ACM or ACBM that can be identified by color, texture, or composition. Also inclusive of dust, if the dust is determined by an accredited inspector to be ACM.

G. Authorized Visitor: The Owner, the Engineer, testing lab personnel, the Engineer/Engineer, emergency personnel, or a representative of any federal, state, and local regulatory or other agency having authority over the project.

H. Barrier: Any surface that seals off the work area to inhibit the movement of fibers.

I. Breathing Zone: A hemisphere forward of the shoulders with a radius of approximately 6 to 9 inches.

J. Ceiling Concentration: The concentration of an airborne substance that shall not be exceeded.

K. Decontamination Facility: A series of interconnected chambers, typically segregated by polyethylene barriers, that is used as the only means of worker ingress/egress to the work area. Interlocking barriers prevents contamination of areas outside the work area.

L. Disposal Bag: A properly labeled 6-mil thick leak-tight plastic bag used for transporting asbestos waste from work and to disposal site.

M. Encapsulant: A material that surrounds or embeds asbestos fibers in an adhesive matrix in order to prevent release of fibers.

1. *Bridging encapsulant*: an encapsulant that forms a discrete layer on the surface of an in situ asbestos matrix.

2. *Penetrating encapsulant*: an encapsulant that is absorbed by the in situ asbestos matrix without leaving a discrete surface layer.

N. Encapsulation: Treatment of asbestos-containing materials with an encapsulant.

O. Equipment Room: A contained room or chamber positioned immediately contiguous to the contaminated work area environment that is used for removal of protective clothing and decontamination of equipment.

P. Friable Asbestos Material: Material that contains more than 1.0% asbestos by weight and that can be crumbled, pulverized, or reduced to powder by hand pressure when dry.

Q. HEPA Filter: A High Efficiency Particulate Air (HEPA) filter capable of trapping and retaining 99.97% of asbestos fibers greater than 0.3 microns in diameter.

R. HEPA Filter Vacuum Collection Equipment (or vacuum cleaner): High efficiency particulate air filtered vacuum collection equipment with a filter system capable of collecting and retaining asbestos fibers. Filters should be of 99.97% efficiency for retaining fibers of 0.3 microns or larger.

S. Negative Pressure Respirator: A respirator in which the air pressure inside the respiratory-inlet covering is positive during exhalation in relation to the air pressure of the outside atmosphere and negative during inhalation in relation to the air pressure of the outside atmosphere.

T. Negative Pressure Ventilation System: A pressure differential and ventilation system.

U. Personal Monitoring: Sampling of the asbestos fiber concentrations within the breathing zone of an employee.

V. Pressure Differential and Ventilation System: A local exhaust system, utilizing HEPA filtration, capable of maintaining a pressure differential within the Work Area at a lower pressure than any adjacent area, and which cleans recirculated air or generates a constant air flow from adjacent areas into the Work Area.

W. Protection Factor: The ratio of the ambient concentration of an airborne substance to the concentration of the substance inside the respirator at the breathing zone of the wearer. The protection factor is a measure of the degree of protection provided by a respirator to the wearer.

X. Respirator: A device designed to protect the wearer from the inhalation of harmful atmospheres.

Y. Surfactant: A chemical wetting agent added to water to improve penetration, thus reducing the quantity of water required for a given operation or area.

Z. Time Weighted Average (TWA): The average concentration of a contaminant in air during a specific time period.

AA. Visible Debris: Any visually detectable particulate residue such as dust, dirt, or other extraneous material that may or may not contain asbestos.

BB. Visible Emissions: Any emissions containing particulate asbestos material that are visually detectable without the aid of instruments. This does not include condensed uncombined water vapor.

CC. Wet Cleaning: The process of eliminating asbestos contamination from building surfaces and objects by using cloths, mops, or other cleaning utensils which have been dampened with amended water or diluted removal encapsulant and afterwards thoroughly decontaminated or disposed of as asbestos-contaminated waste.

DD. Work Area: The area where asbestos-related work or removal operations are performed which is defined and/or isolated to prevent the spread of asbestos dust, fibers, or debris, and entry by unauthorized personnel. Work area is a Regulated Area as defined by 29 CFR 1926.

1.4 STOP WORK

A. If the Engineer or Owner presents a signed written stop work order, stop abatement work immediately. Do not recommence work until authorized in writing by the Owner.

1.5 SUBMITTALS

A. Submit the following items to the Engineer for review and approval. Do not begin work until the Engineer has approved these submittals.

1. Plan of Action: Submit a detailed plan of the procedures proposed for use in complying with the requirements of this Section. Include in the plan the location and layout of decontamination areas, the sequencing of asbestos work, the interface of trades involved in the performance of work, methods to be used to assure the safety of building occupants and visitors to the site, disposal plan including location of approved disposal site, and a detailed description of the methods to be employed to control pollution. Expand upon the use of portable HEPA ventilation system, closing out of the building's HVAC system, method of removal to prohibit visible emissions in work area, and packaging of removed asbestos debris. The Engineer prior to commencement of work must approve the plan.

2. Contingency plans for emergency actions.

3. Resume of Supervisor for asbestos abatement.

4. Accreditation and Certification: submit evidence in form of training course certificate of accreditation of Supervisor as an asbestos abatement supervisor and Workers as asbestos abatement workers. Also, submit applicable Massachusetts DLWD personnel certifications. All personnel also must carry certifications on-site. Personnel without such certificates may not perform any functions related to asbestos abatement.

5. Permit: Submit evidence that asbestos waste transporter maintains a current "Industrial waste hauler permit" specifically for asbestos-containing materials, as required for transporting of asbestos-containing materials waste to a disposal site.

6. Waste disposal: Submit name, address, telephone number and asbestos waste permit information for landfill where asbestos waste will be disposed.

B. Submit the following for the Engineer's Information:

1. Telephone numbers and location of emergency services.

2. Copy of Notifications sent to other entities at the work site.

3. Copy of Notifications sent to emergency service agencies.

4. Permits, Licenses, and Certificates: For the Engineer's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, and similar documents, correspondence and records established in conjunction with compliance with standards and regulations bearing upon performance of the Work including:

    a. State and Local Regulations: Submit copies of codes and regulations applicable to the work.
    b. Notices: Submit notices required by federal, state and local regulations together with proof of timely transmittal to agency requiring the notice.
    c. Permits: Submit copies of current valid permits required by state and local regulations.
    d. Licenses: Submit copies of all State and local licenses and permits necessary to carry out the work of this contract, including abatement contractor's Massachusetts Department of Labor and Industries asbestos abatement contractor license.

5. Respiratory Protection Program: Submit program manual, protection schedule, and historic airborne fiber data applicable to this project.

C. Asbestos Abatement Schedule: Provide proposed detailed schedule including work dates, work shift time, number of employees, dates of start and completion including dates of preparation work, removals and final inspection dates.

1. Indicate completion and Clearance of each Work Area in advance of the date established for Substantial Completion. Allow time for testing and other Engineer's procedures necessary for certification of Clearance and Substantial Completion.

2. Work Stages: Indicate important stages of construction for each major portion of the work, including testing and installation. Include indication of start and finish times for the following:

    a. Preparation of the Work Area.
    b. Asbestos removal.
    c. Clearance testing.

3. Schedule Updating: Revise the schedule after each meeting or activity where revisions have been recognized or made. Issue the updated schedule concurrently with report of each meeting.

D. Five days before removing asbestos materials, contractor shall evaluate the quantity of asbestos containing materials in each area of work and submit the quantity for written approval to the Engineer. It shall include the location, date, quantity of asbestos material, and name of the authorized person conducting the quantification. The

Owner's Air Monitoring Technician shall verify all asbestos material quantification before work is begun.

E. At completion of asbestos abatement, submit copies of the waste shipment record(s) for all asbestos waste transported from the site, copies of worker logs, copies of workers' certifications as asbestos abatement workers, and any other pertinent information relative to the project.

1.6 NOTIFICATIONS

A. Notify other entities at the job site of the nature of the asbestos abatement activities, location of asbestos-containing materials, requirements relative to asbestos set forth in these specifications and applicable regulations.

B. Notify emergency service agencies including fire, ambulance, police or other agency that may service the abatement work site in case of an emergency. Notification is to include methods of entering work area, emergency entry and exit locations, modifications to fire notification or fire fighting equipment, and other information needed by agencies providing emergency services.

C. Notifications of Emergency: Any individual at the job site may notify emergency service agencies if necessary without effect on this Contract or the Contract Sum.

D. Notify federal, state, and local agencies having jurisdiction over the work including:

1. Environmental Protection Agency: In Massachusetts, the notification sent to the Massachusetts Department of Environmental Protection for asbestos removal will be sufficient to meet the EPA notification requirement under the National Emission Standards for Hazardous Air Pollutants (NESHAPS) Asbestos Regulations (40 CFR 61 Subpart M).

2. State and Local Agencies: Send written notification and pay fees, as applicable, as required by state and local regulations prior to beginning any work on asbestos-containing materials. In Massachusetts, notify the Department of Environmental Protection and the Department of Labor and Workforce Development within 10 working days of beginning any asbestos abatement.

3. Notify the local Department of Health and Fire Department within 10 days of beginning any asbestos abatement.

1.7 QUALITY ASSURANCE

A. Licenses: The Contractor conducting asbestos abatement activities must maintain current licenses as required by applicable state or local jurisdictions for the removal, transporting, disposal or other regulated activity relative to the work of this contract, including a Massachusetts Department of Labor and Industries license as an Asbestos Abatement Contractor.

B. Certifications: All personnel conducting asbestos abatement activities shall be certified by the Department of Labor and Work Force Development as Asbestos Abatement Workers and Asbestos Abatement Supervisors, as applicable, to their role on the project.

C. Continuously monitor and record the pressure differential between the Work Area and the building outside of the Work Area with a monitoring device.

1.8 PROJECT/SITE CONDITIONS

A. The disturbance or dislocation of asbestos-containing materials (ACM) may cause asbestos fibers to be released into the buildings atmosphere, thereby creating a potential health hazard to workers and building occupants. Thus, to prevent ACM from becoming a hazard, the Contractor shall abate the ACM in the proper sequence of the project before the materials are disturbed by any renovation or demolition. Apprise all workers, supervisory personnel, subcontractors and consultants who will be at the job site of the seriousness of the hazard and of proper work procedures that must be followed.

B. Where in the performance of the work, workers, supervisory personnel, subcontractors, or Consultants may encounter, disturb, or otherwise function in the immediate vicinity of any identified asbestos-containing materials or any material suspected of containing asbestos, take appropriate precautionary measures as necessary to protect all building occupants from the potential hazard of exposure to airborne asbestos. Such measures shall include the procedures and methods described herein, and compliance with regulations of applicable federal, state and local agencies. Materials that may be encountered that are not included in the following table that are suspected of containing asbestos should be assumed to contain asbestos unless appropriate testing and analysis demonstrates otherwise.

C. Asbestos has been identified in the following materials. Please refer to Appendices A and C more information on these materials.

Results of Testing for Asbestos
Edgell Road Water Pumping Station
Framingham, Massachusetts

Type of Material	Location	Quantity
Gray exterior door caulking	Front and rear of building	4 Doors
Gray exterior window caulking	Front and sides of the building	12 windows

Results of Testing for Asbestos Saxonville Pumping Station Framingham, Massachusetts	
Type of Material	**Location**
Rolled Roof/Sealant Composite	Parapet Roof
Roof Base Layer Composite	Parapet Roof
Roof Layers Composite	Tar and Gravel Roof

1.9 OWNER'S TESTING

A. The Owner will employ a Testing and Inspection Agency to perform the air monitoring specified in this Article in order to verify that the building beyond the work area and the outside environment remains uncontaminated.

1. This Article also sets forth airborne fiber levels both inside and outside the work area as action levels, and describes the action required by the Contractor if an action level is met or exceeded.

2. Analytical Methods: The following methods will be used by the Owner's Testing and Inspection Agency in analyzing filters used to collect air samples. Sampling rates may be varied from printed standards to allow for high volume sampling.

a. Phase Contrast Microscopy (PCM) will be performed using the NIOSH 7400 method. This analysis will be carried out at the job site.

B. Air monitoring required by OSHA is work of the Contractor and is not covered in this section.

C. Work Area Isolation: The purpose of the Owner's Testing and Inspection Agency air monitoring during abatement work is to detect faults in the work area isolation such as:

1. Contamination of the building outside of the work area with airborne asbestos fibers,

2. Failure of filtration or rupture in the differential pressure system,

3. Contamination of air outside the building envelope.

4. Should any of the above occur, immediately cease asbestos abatement activities until the fault is corrected. Do not recommence work until authorized by the Architect.

D. Work Area Airborne Fiber Count: The Owner's Testing and Inspection Agency will monitor airborne fiber counts in the Work Area. The purpose of this air monitoring will be to detect airborne asbestos concentrations that may challenge the ability of the Work Area isolation procedures to protect the balance of the building or outside of the building from contamination by airborne fibers.

E. Work area clearance: To determine if the elevated airborne fiber counts encountered during abatement operations have been reduced to an acceptable level, the Owner's Testing and Inspection Agency will sample and analyze air samples in accordance with the requirements of 40 CFR Part 763.

1. Aggressive Sampling: Air samples will be taken using aggressive sampling techniques as follows:

   a) Before sampling pumps are started the exhaust from forced-air equipment (leaf blower with an approximately 1 horsepower electric motor) will be swept against walls, ceilings, floors, ledges and other surfaces in the room. This procedure will be continued for 5 minutes per 10,000 cubic feet of room volume.

   b) One 20-inch diameter fan per 10,000 cubic feet of room volume will be mounted in a central location at approximately 2 meters above floor, directed toward ceiling and operated at low speed for the entire period of sample collection.

   c) Air samples will be collected in areas subject to normal air circulation away from room corners, obstructed locations, and sites near windows, doors of vents.

   d) After air-sampling pumps have been shut off, fans will be shut off.

2. Schedule of Air Samples: The number and volume of air samples taken and analytical methods used by the Architect will be in accordance with the following schedule. Sample volumes given may vary depending upon the analytical instruments used.

   a. Testing for airborne fiber concentration will be performed using Phase Contrast Microscopy. In each homogeneous Work Area, after completion of cleaning work, a minimum of five samples will be taken and analyzed. Samples will be collected 0.8 mixed cellulose ester filter media in 25-millimeter cassettes with a conductive extension cowl.

Location Sampled	Number of Samples	Analysis Method	Detection Limit Fibers/cc	Minimum Volume (LITERS)	Rate (LPM)
Each Work Area Or	1/1000 sf	PCM	0.01	1,200	1-10
Each room	1	PCM	0.01	1,200	1-10
Work Area Blank	1	PCM	0.01	0	Open for 30 Seconds
Lab Blank	1	PCM	0.01	0	Do not open

1) Analysis: Fibers on each filter will be measured using the NIOSH Method 7400 entitled "Fibers" published in the NIOSH Manual of Analytical Methods, 3rd Edition, Second Supplement, August 1987.

2) Fibers referred to in this section include fibers regardless of composition as counted by the phase contrast microscopy method used.

3) Release Criteria: Decontamination of the work site is complete when every Work Area sample is at or below 0.01 fibers per cubic centimeter of air (f/cc). If any sample is above this level, then the decontamination is incomplete and recleaning per Article 3.3 of this Section is required.

b. If clearance criteria cannot be met by PCM analysis due to site conditions, testing for airborne fiber concentration will be performed using Transmission Electron Microscopy. Samples will be collected and analyzed according to the AHERA method specified in 40 CFR Part 763.

1) Release Criteria: Decontamination of the work site is complete when every Work Area sample is at or below the criteria specified by AHERA. If these release criteria are not met, then the decontamination is incomplete and recleaning per Article 3.3 of this Section is required.

3. Laboratory Testing:

a. PHASE CONTRAST MICROSCOPY: Typically, the Owner's Testing and Inspection Agency will analyze all PCM air samples on-site and results made available within 3 to 6 hours. However, if required, the services of a testing laboratory will be employed by the Owner to perform laboratory analysis of the air samples. Results will be available within 24 hours of completion of the sampling period. A complete record, certified by the testing laboratory, of air monitoring tests and results will be furnished to the Architect, the Owner and the Contractor.

b. TRANSMISSION ELECTRON MICROSCOPY: Samples will be sent by overnight courier for analysis by Transmission Electron Microscopy within 24 hours of receipt by laboratory. Samples will not be carried on weekends, so that samples shipped on Friday will arrive on the following Monday. Verbal results will normally be available during the 2nd working day after receipt of samples by the laboratory. The laboratory is capable of analyzing a maximum of 13 such samples from this project at any one time. Transmission Electron Microscopy results will be available to the Contractor.

F. Stop Action Levels:

1. Inside Work Area: Maintain an average airborne count in the Work Area of less than 0.5 fibers per cubic centimeter. If the fiber counts rise above this figure for any sample taken, revise work procedures to lower fiber counts. If the Time Weighted Average (TWA) fiber count for any work shift or 8-hour period exceeds 0.5 fibers per cubic centimeter, stop work, leave Pressure Differential System in operation and notify Architect. After correcting cause of high fiber levels, do not recommence work for 24 hours unless otherwise authorized, in writing, by Architect.

a. If airborne fiber counts exceed 2.0 fibers per cubic centimeter for any period of time cease all work except corrective action until fiber counts fall below 0.5 fibers per cubic centimeter and notify Architect. After correcting cause of high fiber levels, do not recommence work for 24 hours unless otherwise authorized, in writing, by Architect.

2. Outside Work Area: If any air sample taken outside of the Work Area exceeds 0.01 fibers/cc, immediately and automatically stop work except corrective action. The Architect will determine the source of the high reading and so notify the Contractor.

a. If the high reading was the result of a failure of Work Area isolation measures initiate the following actions:

1) Immediately erect new critical barriers to isolate the affected area from the balance of the building. Erect Critical Barriers at the next existing structural isolation of the involved space (e.g. wall, ceiling, floor).

2) Decontaminate the affected area in accordance with the requirements of Part 3.06 of this Section.

3) Require that respiratory protection be worn in affected area until area is cleared for reoccupancy in accordance with Work Area Clearance requirements.

4) Leave Critical Barriers in place until completion of work and insure that the operation of the pressure differential system in the Work Area results in a flow of air from the balance of the building into the affected area.

5) After Certification of Visual Inspection in the Work Area remove critical barriers separating the work area from the affected area. Final air samples will be taken within the entire area as set forth herein.

b. If the high reading was the result of other causes initiate corrective action as determined by the Architect.

G. Complete corrective work if high airborne fiber counts were caused by Contractor's activities.

PART 2 - PRODUCTS

2.1 HEPA FILTERED FAN UNITS:

A. General: Supply the required number of HEPA filtered fan units to the site in accordance with these specifications. Use units that meet the following requirements.

B. Cabinet: Constructed of durable materials able to withstand damage from rough handling and transportation. The width of the cabinet should be less than 30 inches to fit through standard-size doorways. Provide units whose cabinets are:

1. Factory-sealed to prevent asbestos-containing dust from being released during use, transport, or maintenance

2. Arranged to provide access to and replacement of air filters from intake end

3. Mounted on casters or wheels

C. Fans: Rate capacity of fan according to usable air-moving capacity under actual operating conditions.

D. HEPA Filters: Provide units whose final filter is the HEPA type with the filter media (folded into closely pleated panels) completely sealed on all edges with a structurally rigid frame.

1. Provide units with a continuous rubber gasket located between the filter and the filter housing to form a tight seal.

2. Provide HEPA filters that are individually tested and certified by the manufacturer to have an efficiency of not less than 99.97 percent when challenged with 0.3 µm dioctylphthalate (DOP) particles when tested in accordance with Military Standard Number 282 and Army Instruction Manual 136-300-175A. Provide filters that bear a UL586 label to indicate ability to perform under specified conditions.

3. Provide filters that are marked with the name of the manufacturer, serial number, air flow rating, efficiency and resistance, and the direction of test airflow.

E. Prefilters, which protect the final filter by removing the larger particles, are required to prolong the operating life of the HEPA filter. Two stages of prefiltration are required. Provide units with the following prefilters:

1. First-stage prefilter: low-efficiency type (e.g., for particles 100 µm and larger)

2. Second-stage (or intermediate) filter: medium efficiency (e.g., effective for particles down to 5 µm)

F. Provide units with prefilters and intermediate filters installed either on or in the intake grid of the unit and held in place with special housings or clamps.

G. Instrumentation: Provide units equipped with:

1. Magnehelic gauge or manometer to measure the pressure drop across filters and indicate when filters have become loaded and need to be changed

2. A table indicating the usable air-handling capacity for various static pressure readings on the Magnehelic gauge affixed near the gauge for reference, or the Magnehelic reading indicating at what point the filters should be changed, noting Cubic Feet per Minute (CFM) air delivery at that point

3. Elapsed time meter to show the total accumulated hours of operation

H. Safety and Warning Devices: Provide units with the following safety and warning devices:

1. Electrical (or mechanical) lockout to prevent fan from operating without a HEPA filter

2. Automatic shutdown system to stop fan in the event of a rupture in the HEPA filter or blocked air discharge

3. Warning lights to indicate normal operation (green), too high a pressure drop across the filters (i.e., filter overloading) (yellow), and too low of a pressure drop (i.e., rupture in HEPA filter or obstructed discharge) (red)

4. Audible alarm if unit shuts down due to operation of safety systems

I. Electrical components: Provide units with electrical components approved by the National Electrical Manufacturers Association (NEMA) and Underwriter's Laboratories (UL). Each unit is to be equipped with overload protection sized for the equipment. The motor, fan, fan housing, and cabinet are to be grounded.

2.2 SHEET PLASTIC

A. Polyethylene Sheet: Provide flame-resistant polyethylene film that conforms to requirements set forth by the National Fire Protection Association Standard 701, Small Scale Fire Test for Flame-Resistant Textiles and Films. Provide largest size possible to minimize seams, 6.0 mil thick, frosted or black as indicated.

B. Reinforced Polyethylene Sheet: Where plastic sheet constitutes the only barrier between the work area and the building exterior, provide translucent, nylon reinforced or woven polyethylene, laminated, flame resistant, polyethylene film that conforms to requirements set forth by the National Fire Protection Association Standard 701, Small Scale Fire Test for Flame-resistant Textiles and Films. Provide largest size possible to minimize seams, 6.0 mil thick, frosted or black as indicated.

2.3 MISCELLANEOUS MATERIALS

A. Duct Tape: Provide duct tape in 2" or 3" widths as indicated, with an adhesive that is formulated to stick aggressively to sheet polyethylene.

B. Spray Glue: Provide spray adhesive in aerosol cans which is specifically formulated to stick tenaciously to sheet polyethylene.

C. Wetting Materials: For wetting prior to disturbance of Asbestos-Containing Materials use either amended water or a removal encapsulant:

1. Amended Water: Provide water to which a surfactant has been added. Use a mixture of surfactant and water which results in wetting of the Asbestos-Containing Material and retardation of fiber release during disturbance of the material equal to or greater than that provided by the use of one ounce of a surfactant consisting of 50% polyoxyethylene ester and 50% polyoxyethylene ether mixed with five gallons of water.

2. Removal Encapsulant: Provide a penetrating type encapsulant designed specifically for removal of Asbestos-Containing Material. Use a material which results in wetting of the Asbestos-Containing Material and retardation of fiber release during disturbance of the material equal to or greater than that provided by water amended with a surfactant consisting of one ounce of a mixture of 50% polyoxyethylene ester and 50% polyoxyethylene ether in five gallons of water.

D. Disposal Bags: Provide 6 mil thick leak-tight polyethylene bags labeled as required by Article 3.08 of this Section.

E. Fiberboard Drums: Provide heavy-duty leak tight fiberboard drums with tight sealing locking metal tops.

F. Paper board Boxes: Provide heavy-duty corrugated paperboard boxes coated with plastic or wax to retard deterioration from moisture. Provide in sizes that will easily fit in disposal bags.

2.4 PROTECTIVE CLOTHING:

A. Coveralls: Provide disposable full-body coveralls and disposable head covers (Tyvek or approved equal), and require that workers in the Work Area wear them. Provide a sufficient number for required changes, for workers in the Work Area.

B. Boots: Provide work boots with non-skid soles, and where required by OSHA, foot protection, for workers. Provide boots at no cost to workers. Paint uppers of boots red with waterproof enamel. Do not allow boots to be removed from the Work Area for any reason, after being contaminated with asbestos-containing material. Dispose of boots as asbestos-contaminated waste at the end of the work.

C. Hard Hats: Provide head protection (hard hats) as required by OSHA for workers, and provide 4 spares for use by Engineer, Project Administrator, and Owner. Label hats with same warning labels as used on disposal bags. Require hard hats to be worn at all times that work is in progress that may potentially cause head injury. Provide hard hats of type with plastic strap type suspension. Require hats to remain in the Work Area throughout the work. Thoroughly clean, decontaminate and bag hats before removing them from Work Area at the end of the work.

D. Goggles: Provide eye protection (goggles) as required by OSHA for workers involved in scraping, spraying, or any other activity which may potentially cause eye injury. Thoroughly clean, decontaminate and bag goggles before removing them from Work Area at the end of the work.

E. Gloves: Provide work gloves to workers and require that they be worn at all times in the Work Area Do not remove gloves from Work Area and dispose of as asbestos-contaminated waste at the end of the work.

2.5 AIR PURIFYING RESPIRATORS

A. Filter Cartridges: Provide, at a minimum, HEPA type filters labeled with NIOSH and MSHA Certification for "Radionuclides, Radon Daughters, Dust, Fumes, Mists including Asbestos-Containing Dusts and Mists" and color coded in accordance with ANSI Z228.2 (1980). In addition, a chemical cartridge section may be added, if required, for solvents, etc., in use. In this case, provide cartridges that have each section of the combination canister labeled with the appropriate color code and NIOSH/MSHA Certification.

B. Do not use single use, disposable or quarter face respirators.

2.6 ADDITIONAL PROTECTIVE EQUIPMENT

A. Respirators, disposable coveralls, head covers, and footwear covers shall be provided by the Contractor for the Engineer, Owner's Consultant, Project Administrator, and other authorized representatives who may inspect the job site. Provide two respirators and six complete coveralls and, where applicable, six respirator filter changes per day.

PART 3 - EXECUTION

3.1 PREPARATION

A. Sequence of Work: Carry out work of this section sequentially. Complete each activity before proceeding to the next.

B. General:

1. The work of this part is required for the removal of all types of ACM, including both friable and nonfriable materials, unless otherwise noted.

2. Work Area: The location where asbestos-abatement work occurs. It is a variable of the extent of work of the Contract. It may be a portion of a room, a single room, or a complex of rooms. A "Work Area" is considered contaminated during the work, and must be isolated from the balance of the building, and decontaminated at the completion of the asbestos-control work.

3. Completely isolate the Work Area from other parts of the building so as to prevent asbestos-containing dust or debris from passing beyond the isolated area. Should the area beyond the Work Area(s) become contaminated with asbestos-containing dust or debris as a consequence of the work, clean those areas in accordance with the procedures indicated in Article 1.10 of this Section. Perform such required cleaning or decontamination at no additional cost to owner.

4. Place tools, scaffolding, staging, etc. necessary for the work in the area to be isolated prior to completion of Work Area isolation.

5. Remove furniture out of the Work Area into a temporary storage location the Owner will designate. Also remove uncontaminated equipment, and/or supplies from the Work Area before commencing work, or completely cover with two layers of polyethylene sheeting, at least 6 mil in thickness, securely taped in place with duct tape. Such furniture and equipment shall be considered outside the work area unless covering plastic or seal is breached.

6. Disable ventilating systems or any other system bringing air into or out of the Work Area. Disable system by disconnecting wires, removing circuit breakers, by lockable switch or other positive means that will prevent accidental premature restarting of equipment.

7. Lockout power to Work Area by switching off breakers serving power or lighting circuits in work area. Label breakers with tape over breaker with notation "DANGER circuit being worked on." Lock panel and have keys under control of Contractor's Superintendent.

8. Lockout power to circuits running through work area wherever possible by switching off breakers or removing fuses serving these circuits. Label breakers with tape over breaker with notation "DANGER circuit being worked on". Lock panel and have keys under control of contractor's superintendent. If circuits cannot be shut down, label at intervals 4'-0" on center with tags reading, "DANGER live electric circuit. Electrocution hazard." Label in a similar manner circuits in hidden locations but which may be affected by the work.

C. Emergency Exits: At each existing exit door from the Work Area provide the following means for emergency exiting

1. Arrange exit door so that it is secure from outside the Work area but permits exiting from the Work Area.

2. Mark outline of door on Primary and Critical Barriers with luminescent paint at least 1" wide. Hang a razor knife on a string beside outline. Arrange Critical and Primary barriers so that they can be easily cut with one pass of razor knife. Paint words "EMERGENCY EXIT" inside outline with luminescent paint in letters at least one foot high and 2" thick.

3. Provide clearly visible/easily distinguished EXIT sign at each exit.

4. Provide battery-operated emergency lighting that switches on automatically in the event of a power failure.

D. Control Access:

1. Isolate the Work Area to prevent entry by building occupants into Work Area or surrounding controlled areas. Accomplish isolation by the following:

a). Lock doors into Work Area, or, if doors cannot be locked, chain shut. Cover signs that direct emergency exiting, either outside or inside of Work Area, to locked doors. Do not obstruct doors required for emergency exits from Work Area or from building.

b). After receiving written authorization from the Engineer construct partitions or closures across any opening into Work Area. Partitions are to be a minimum of 8 feet high.

c). Fabricate partitions from 3-5/8", 25 gage metal studs or 2" x 4" wood studs with 1/2" gypsum board on both faces. Brace at 4'-0" on center.

d). Locked Access: Arrange Work Area so that the only access into Work Area is through lockable doors to personnel and equipment decontamination units.

e). Install temporary doors with entrance type locksets that are key lockable from the outside and always unlocked and operable from the inside. Do not use deadbolts or padlocks.

7. Replace locksets or passage sets on doors leading to decontamination units with temporary locksets for duration of the project. Remove any deadbolts or padlocks. Use entry type locksets that are key lockable from outside and always unlocked and operable from inside.

   a. Provide one key for each door to Owner, and Engineer and maintain one key in clean room of decontamination unit (3 total).

8. Visual Barrier: Where the Work Area is immediately adjacent to or within view of occupied areas, provide a visual barrier of opaque polyethylene sheeting at least 6 mil in thickness so that the work procedures are not visible to building occupants. Where this visual barrier would block natural light, substitute frosted or woven rip-stop sheet plastic in locations approved by the Engineer.

9. Provide warning signs at each locked door leading to Work Area reading as follows:

Legend	Notation
KEEP OUT	3" Sans Serif Gothic or Block
BEYOND THIS POINT	1" Sans Serif Gothic or Block
ASBESTOS ABATEMENT WORK	1" Sans Serif Gothic or Block
IN PROGRESS	1" Sans Serif Gothic or Block
BREATHING ASBESTOS DUST MAY BE HAZARDOUS TO YOUR HEALTH	14 Point Gothic

Immediately inside door and outside critical barriers post an approximately 20 inch by 14 inch manufactured caution sign displaying the following legend with letter sizes and styles of a visibility required by 29 CFR 1926:

LEGEND

DANGER

ASBESTOS

CANCER AND LUNG DISEASE HAZARD
RESPIRATORS AND PROTECTIVE CLOTHING ARE REQUIRED
IN THIS AREA

E. Alternate Methods of Enclosure: Alternate methods of containing the Work Area may be submitted to the Engineer for approval. Do not proceed with any such method(s) without approval of the Engineer.

F. Respiratory and Worker Protection: Before proceeding beyond this point in providing Temporary Enclosures:

1. Provide Worker Protection per Article 3.2.

2. Provide Respiratory Protection per Article 3.3

3. Provide Personnel Decontamination Unit per Article 3.4.

G. Critical Barriers:

1. Completely separate the Work Area from other portions of the building and the outside by closing openings with two sheet plastic barriers at least 6 mil in thickness each, and by sealing cracks leading out of Work Area with duct tape.

2. Individually seal ventilation openings (supply and exhaust), lighting fixtures, clocks, doorways, windows, convectors and speakers, and other openings into the Work Area with duct tape alone or with polyethylene sheeting at least 6 mil in thickness, taped securely in place with duct tape. Maintain seal until all abatement work including Project Decontamination is completed. Take care in sealing of lighting fixtures to avoid melting or burning of sheeting.

3. Mechanically support sheet plastic independently of duct tape or spray glue seals so that seals do not support the weight of the plastic. Following are acceptable methods of supporting sheet plastic barriers. Alternative support methods may be used if approved in writing by the Engineer.

a. Plywood squares 6" x 6" x 3/8" held in place with one 6d smooth masonry nail or electro-galvanized common nail driven through center of the plywood and duct tape on plastic so that plywood clamps plastic to the wall. Locate plywood squares at each end, corner and at maximum 4 feet on centers.

b. Nylon or polypropylene rope or wire with a maximum unsupported span of 10 feet, minimum 1/4" in diameter suspended between supports securely fastened on either side of opening at maximum 1 foot below ceiling. Tighten rope so that it has 2" maximum dip. Drape plastic over rope from outside Work Area so that a two-foot long flap of plastic extends over rope into Work Area. Staple or wire plastic to itself 1" below rope at maximum 6" on centers to form a sheath over rope. Lift flap and seal to ceiling with duct tape or spray cement. Seal loop at bottom of flap with duct tape. Erect entire assembly so that it hangs vertically without a "shelf" upon which debris could collect.

4. Provide Pressure Differential System per Part 3.1 L of this Section.

5. Clean housings and ducts of over spray materials prior to erection of any Critical Barrier that will restrict access.

H. Prepare Area:

1. Scaffolding: If fixed scaffolding is to be used to provide access, HEPA vacuum and wet clean area prior to scaffolding installation.

2. Remove electrical and mechanical items, such as lighting fixtures, clocks, diffusers, and registers that cover any part of the surface to be worked on.

3. Remove general construction items such as cabinets, casework, door and window trim, moldings, ceilings, and trim that cover the surface of the work as required to prevent interference with the work. Clean, decontaminate and reinstall such materials, upon completion of removal work with materials, finishes, and workmanship to match existing installations before start of work.

4. Clean contaminated furniture, equipment, and or supplies with a HEPA filtered vacuum cleaner or by wet cleaning. Remove movable objects out of the Work Area to a temporary storage location designated by the Engineer.

5. Clean surfaces in Work Area with a HEPA filtered vacuum or by wet wiping prior to the installation of primary barrier.

I. Primary Barrier:

1. Protect building and other surfaces in the Work Area from damage from water and high humidity and from contamination from asbestos-containing debris, slurry or high airborne fiber levels by covering with a primary barrier as described below.

2. Sheet Plastic: Protect surfaces in the Work Area with two layers of plastic sheeting on floors, ceilings and walls, or as otherwise directed by the Owner's Inspection and Testing Agency. Perform work in the following sequence.

a. Cover Floor of Work Area with 2 individual layers of clear polyethylene sheeting (except where floor tile or soil abatement is occurring), each at least 6 mil in thickness, turned up walls at least 12 inches. Form a sharp right angle bend at junction of floor and wall so that there is no radius that could be stepped on causing the wall attachment to be pulled loose. Both spray-glue and duct tape seams in floor covering. Locate seams in top layer six feet from, or at right angles to, seams in bottom layer. Install sheeting so that top layer can be removed independently of bottom layer.

b. Cover walls in Work Area including "Critical Barrier" sheet plastic barriers with two layers of polyethylene sheeting at least 6 mils in thickness, mechanically supported and sealed with duct tape or spray-glue in the same manner as described above for "critical barriers. Tape joints including the joining with the floor covering with duct tape or as otherwise indicated on the Contract Documents or in writing by the Engineer.

c. Similarly, cover suspended ceiling tile, acoustical plaster ceiling, and other ceilings with a porous surface, with a minimum of one layer of polyethylene sheeting, at least 6 mil in thickness.

d. Repair of Damaged Polyethylene Sheeting: Remove and replace plastic sheeting that has been damaged by removal operations or where seal has failed allowing water to seep between layers. Remove affected sheeting and wipe down entire area. Install new sheet plastic only when area is completely dry.

J. Stop Work: If the Critical or Primary barrier falls or is breached in any manner stop work immediately. Do not start work until authorized in writing by the Engineer.

K. Exterior Enclosures: Construct exterior enclosures as a Critical Barrier as necessary to completely enclose the work. Fabricate from reinforced polyethylene sheeting and 2"x4" wood framework. Attach to existing building components or brace as necessary for lateral stability. Construct walls to meet state and local regulations for construction of temporary buildings.

L. Pressure Differential Isolation:

1. Isolate the Work Area from adjacent areas or systems of the building with a Pressure Differential that will cause a movement of air from outside to inside at any breach in the physical isolation of the Work Area.

2. Relative Pressure in Work Area: Continuously maintain the work area at an air pressure that is lower than that in any surrounding space in the building, or at any location in the immediate proximity outside of the building envelope. This pressure differential when measured across any physical or critical barrier must equal or exceed a static pressure of:

- 0.02 inches of water.

Install manometer and related tubing to continuously measure pressure differential.

3. Accomplish the pressure differential by exhausting a sufficient number of HEPA filtered fan units from the work area. The number of units required will depend on machine characteristics, the seal at barriers, and required air circulation. The number of units will increase with increased make-up air or leaks into the Work Area. Determine the number of units required for pressure isolation by the following procedure:
   a. Establish required air circulation in the work area, personnel and equipment decontamination units.
   b. Establish isolation by increased pressure in adjacent areas or as part of seals where required.
   c. Exhaust a sufficient number of units from the work area to develop the required pressure differential.
4. The required number of units is the number determined above plus one additional unit.
5. Vent HEPA filtered fan units to outside of building unless authorized in writing by Engineer.
   a. Mount units to exhaust directly or through disposable ductwork.
   b. Use only new ductwork except for sheet metal connections and elbows.
   c. Use ductwork and fittings of same diameter or larger than discharge connection on fan unit.
   d. Use inflatable, disposable plastic ductwork in lengths not greater than 100 feet.
   e. Use spiral wire-reinforced flex duct in lengths not greater than 50 feet.
   f. Arrange exhaust as required to inflate duct to rigidity sufficient to prevent flapping.
   g. If direction of discharge from fan unit is not aligned with duct use sheet metal elbow to change direction. Use six feet of spiral wire reinforced flex duct after direction change.

M. Air Circulation in the Work Area:

1. Air Circulation: For purposes of this section air circulation refers to either the introduction of outside air to the Work Area or the circulation and cleaning of air within the Work Area.

2. Air circulation in the Work Area is a minimum requirement intended to help maintain airborne fiber counts at a level that does not significantly challenge the work area isolation measures. The Contractor may also use this air circulation as part of the engineering controls in his worker protection program.

3. Determining the Air circulation Requirements: Provide a fully operational air circulation system supplying a minimum of 4 air changes per hour.

4. Add one (1) additional unit as a backup in case of equipment failure or machine shutdown for filter changing.

N. Exhaust System: Pressure differential isolation and air circulation in the Work Area are to be accomplished by an exhaust system as described below.

1. Exhaust units from the Work Area to meet air circulation requirement of this section.

2. Location of HEPA Filtered Fan Units: Locate fan unit(s) so that makeup air enters work area primarily through decontamination facilities and traverses Work Area as much as possible. This may be accomplished by positioning the HEPA filtered fan unit(s) at a maximum distance from the worker access opening or other makeup air sources.

3. Vent to outside of building, unless authorized in writing by the Engineer.

4. Decontamination Units: Arrange Work Area and decontamination units so that the majority of make up air comes through the Decontamination Units. Use only personnel or equipment Decontamination Unit at any time and seal the other so that make up air passes through unit in use.

5. Supplemental Makeup Air Inlets: Provide where required for proper air flow through the Work Area in location approved by the Engineer by making openings in the plastic sheeting that allow air from outside the building into the Work Area. Locate auxiliary makeup air inlets as far as possible from the fan unit(s) (e.g., on an opposite wall), off the floor (preferably near the ceiling), and away from barriers that separate the Work Area from occupied clean areas. Cover with flaps to reseal automatically if the pressure differential system should shut down for any reason. Spray flap and around opening with spray adhesive so that if flap closes meeting surfaces are both covered with adhesive. Use adhesive that forms contact bond when dry.

O. Recirculation System: Pressure differential isolation and air circulation in the Work Area are to be accomplished by a recirculation system as described below.

1. Recirculate air in the Work Area through HEPA filtered fan units to accomplish air circulation requirements of this section.

2. Location of Fan Units: Locate HEPA filtered fan units so that air is circulated through all parts of the Work Area, and so that required pressure is maintained at all parts of Work Area geometry. Move units as necessary so that in any location where asbestos-containing materials are being disturbed the discharge from one HEPA filtered fan unit is blowing contamination away from workers. Direct airflow in these locations so that it is predominantly toward workers' backs at the breathing zone elevation.

P. Use of the Pressure Differential and Air Circulation System:

1. General: Each unit shall be serviced by a dedicated minimum 115V-20A circuit with ground fault circuit interrupter (GFCI) supplied from temporary power supply installed by the Contractor's licensed electrician. Do not use existing branch circuits to power fan units.

2. Testing the System: Test pressure differential system before any asbestos-containing material is wetted or removed. After the Work Area has been prepared, the decontamination facility set up, and the fan unit(s) installed, start the unit(s) (one at a time). Demonstrate operation and testing of pressure differential system to Engineer.

3. Demonstrate Condition of Equipment for each HEPA filtered fan unit and pressure differential monitoring equipment including proper operation of the following:

   a. Squareness of HEPA Filter
   b. Condition of Seals
   c. Proper operation of lights
   d. Proper operation of automatic shut down if exhaust is blocked
   e. Proper operation of alarms
   f. Proper operation of magnehelic gauge
   g. Proper operation and calibration on pressure monitoring equipment

4. Demonstrate Operation of the pressure differential system to the Engineer will include, but not be limited to, the following:

   a. Plastic barriers and sheeting move lightly in toward Work Area.
   b. Curtain of decontamination units moves lightly in toward Work Area.
   c. There is a noticeable movement of air through the Decontamination Unit.
   c. Use smoke tube to demonstrate air movement from Clean Room through Shower Room to Equipment Room.
   e. Use smoke tubes to demonstrate a definite motion of air across all areas in which work is to be performed.
   f. Use a differential pressure meter or manometer to demonstrate the required pressure differential at every barrier separating the Work Area from the balance of the building, equipment, duct work or outside.

5. Modify the Pressure Differential System as necessary to demonstrate successfully the above.

6. Use of System during Abatement Operations:

   a. Start fan units before beginning work (before any asbestos-containing material is disturbed). After abatement work has begun, run units continuously to maintain a constant pressure differential and air circulation until decontamination of the work area is complete. Do not turn off units at the end of the work shift or when abatement operations temporarily stop.

   b. Do not shut down air pressure differential system during encapsulating procedures, unless authorized by the Engineer in writing. Supply sufficient pre-filters to allow frequent changes.

   c. Start abatement work at a location farthest from the fan units and proceed toward them. If an electric power failure occurs, immediately stop all abatement work and do not resume until power is restored and fan units are operating again.

   d. At completion of abatement work, allow fan units during final cleaning sequence to remove airborne fibers that may have been generated during abatement work and cleanup and to purge the Work Area with clean makeup air. The units may be required to run for a longer time after decontamination, if dry or only partially wetted asbestos material was encountered during any abatement work.

7. Dismantling the System: When a final inspection and the results of final air tests indicate that the area has been decontaminated, fan units may be removed from the Work Area. Before removal from the Work Area, remove and properly dispose of pre-filter, decontaminate exterior of machine and seal intake to the machine with 6-mil polyethylene to prevent environmental contamination from the filters.

3.2 WORKER PROTECTION AND DECONTAMINATION PROCEDURES

A. The work of this part is required for the removal or other abatement of all types of ACM, including both friable and nonfriable materials unless otherwise noted.

B. Provide worker protection as required by the most stringent OSHA and/or EPA standards applicable to the work. The following procedures are minimums to be adhered to regardless of fiber count in the Work Area.

C. Each time Work Area is entered remove street clothes in the Changing Room of the Personnel Decontamination Unit and put on new disposable coverall, new head cover, and a clean respirator. Proceed through shower room to equipment room and put on work boots.

D. Require workers to adhere to the following personal decontamination procedures whenever they leave the Work Area:

1. When exiting area, remove disposable coveralls, disposable head covers, and disposable footwear covers or boots in the equipment room.

2. Still wearing respirators, proceed to showers. Showering is mandatory. Care must be taken to follow reasonable procedures in removing the respirator to avoid asbestos fibers while showering. The following procedure is required as a minimum:

3. Thoroughly wet body including hair and face. If using a Powered Air-Purifying Respirator (PAPR) hold blower unit above head to keep canisters dry.

4. With respirator still in place thoroughly wash body, hair, respirator face piece, and all parts of the respirator except the blower unit and battery pack on a PAPR. Pay particular attention to seal between face and respirator and under straps.

5. Take a deep breath, hold it and/or exhale slowly, completely wet hair, face, and respirator. While still holding breath, remove respirator and hold it away from face before starting to breath.

6. Carefully wash face piece of respirator inside and out.

7. If using PAPR, shut down in the following sequence, first cap inlets to filter cartridges, then turn off blower unit (this sequence will help keep debris which has collected on the inlet side of filter from dislodging and contaminating the outside of the unit). Thoroughly wash blower unit and hoses. Carefully wash battery pack with wet rag. Be extremely cautious of getting water in battery pack as this will short out and destroy battery.

8. Dispose of wet filters from air purifying respirator.

9. Rinse thoroughly.

10. Rinse shower room walls and floor prior to exit.

11. Proceed from shower to Changing Room and change into street clothes or into new disposable work clothes.

E. Within Work Area: Require that workers NOT eat, drink, smoke, chew tobacco or gum, or apply cosmetics in the Work Area. To eat, chew, drink or smoke, workers shall follow the procedure described above, and then dress in street clothes before entering the non-Work Areas of the building.

3.3 RESPIRATORY PROTECTION

A. Require that respiratory protection be used at all times that there is any possibility of disturbance of asbestos-containing materials whether intentional or accidental.

B. Require that a respirator be worn by anyone in a Work Area at all times, regardless of activity, during a period that starts with any operation which could cause airborne fibers until the area has been cleared for re-occupancy in accordance with Article 1.10 of this Section.

C. Regardless of Airborne Fiber Levels: Require that the minimum level of respiratory protection used be half-face air-purifying respirators with high efficiency filters.

D. Do not allow the use of single-use, disposable, or quarter-face respirators for any purpose.

E. Fit Testing:

1. Initial Fitting: Provide initial fitting of respiratory protection during a respiratory protection course of training set up and administered by a Certified Industrial Hygienist. Fit types of respirator to be actually worn by each individual. Allow an individual to use only those respirators for which training and fit testing has been provided.

2. On a Weekly Basis, check the fit of each worker's respirator by having irritant smoke blown onto the respirator from a smoke tube.

3. Upon Each Wearing: Require that each time an air-purifying respirator is put on it be checked for fit with a positive and negative pressure fit test in accordance with the manufacturer's instructions or ANSI Z88.2 (1980).

F. Type of Respiratory Protection Required: Provide respiratory protection as indicated in accordance with OSHA requirements. In the event that an initial exposure assessment has previously been conducted, determine the proper level of protection by dividing the expected or actual airborne fiber count in the Work Area by the appropriate "protection factors" specified by OSHA for various types of respirators. The level of respiratory protection that supplies an airborne fiber level inside the respirator, at the breathing zone of the wearer, at or below the permissible exposure limit (PEL) is the minimum level of protection allowed.

G. Permissible Exposure Limit (PEL):

1. 8-Hour Time Weighted Average (TWA) of asbestos fibers to which any worker may be exposed shall not exceed 0.1 fiber/cc.

2. 8-Hour Time Weighted Average (TWA) and Ceiling Concentration of asbestos fibers based on a 30 minute period to which any worker may be exposed shall not exceed 1.0 fiber/cc.

3. Contractor must assess asbestos operations for their potential to generate airborne fibers. Contractor must use exposure-monitoring data to assess worker exposures.

4. Fibers: For purposes of this section, fibers are defined as all fibers regardless of composition as counted in the OSHA Reference Method (ORM), or NIOSH 7400 procedure.

L. Air Purifying Respirators:

1. Negative pressure - half or full-face mask: Supply a sufficient quantity of respirator filters approved for asbestos, so that workers can change filters during the workday. Require that respirators be wet-rinsed, and filters discarded, each time a worker leaves the Work Area. Require that new filters be installed each time a worker re-enters the Work Area. Store respirators and filters at the job site in the changing room and protect totally from exposure to asbestos prior to their use.

2. Powered air purifying - half or full face mask: Supply a sufficient quantity of high efficiency respirator filters approved for asbestos so that workers can change filters at any time that flow through the face piece decreases to the level at which the manufacturer recommends filter replacement. Require that regardless of flow, filter cartridges be replaced after 40 hours of use. Require that HEPA elements in filter cartridges be protected from wetting during showering. Require entire exterior housing of respirator, including blower unit, filter cartridges, hoses, battery pack, face mask, belt, and cords, be washed each time a worker leaves the Work Area. Caution should be used to avoid shorting battery pack during washing. Provide an extra battery pack for each respirator so that one can be charging while one is in use.

M. Type "C" Respirator: Continuously monitor the air system operation including compressor operation, filter system operation, backup air capacity and warning and monitoring devices at all times that system is in operation. Assign an individual, trained by manufacturer of the equipment in use or by a Certified Industrial Hygienist, in the operation and maintenance of the system to provide this monitoring. Assign no other duties to this individual that will take him away from monitoring the air system.

3.4 DECONTAMINATION UNITS

A. Personnel Decontamination Unit: Provide a Personnel Decontamination Unit consisting of a serial arrangement of connected rooms or spaces, Clean Room, Shower Room, Equipment Room with airlocks between spaces. Require all persons without exception to pass through this Decontamination Unit for entry into and exiting from the Work Area for any purpose. Do not allow parallel routes for entry or exit. Do not remove equipment or materials through Personnel Decontamination Unit. Provide temporary lighting within Decontamination Units as necessary to reach a lighting level of 100-foot candles.

1. Changing Room (clean room): Provide a room that is physically and visually separated from the rest of the building for the purpose of changing into protective clothing.

    a. Construct using polyethylene sheeting, at least 6 mil in thickness, to provide an airtight seal between the Changing Room and the rest of the building.

    b. Locate so that access to Work Area from Changing Room is through Shower Room.

    c. Separate Changing Room from the building by a sheet plastic flapped doorway.

    d. Require workers to remove street clothes in this room, dress in clean, disposable coveralls, and don respiratory protection equipment. Do not allow asbestos-contaminated items to enter this room. Require Workers to enter this room either from outside the structure dressed in street clothes, or naked from the showers.

    e. An existing room may be utilized as the Changing Room if it is suitably located and of a configuration whereby workers may enter the Changing Room directly from the Shower Room. Protect surfaces of room with sheet plastic as set forth in Temporary Enclosures. Authorization for this must be obtained from the Engineer in writing prior to start of construction.

    f. Maintain floor of changing room dry and clean at all times. Do not allow overflow water from shower to wet floor in changing room.

    g. Damp wipe surfaces twice after each shift change with a disinfectant solution.

    h. Provide posted information for emergency phone numbers and procedures.

2. Airlocks: Provide an airlock between Clean Room and Shower Room and an airlock (3' minimum) between shower room and equipment room.

3. Shower Room: Provide a completely watertight operational shower to be used for transit by cleanly dressed workers heading for the Work Area from the Changing Room, or for showering by workers headed out of the Work Area after undressing in the Equipment Room.

    a. Construct room by providing a shower pan and 2 shower walls in a configuration that will cause water running down walls to drip into pan. Install a freely draining wooden floor in shower pan at elevation of top of pan.

    b. Separate this room from the rest of the building with airtight walls fabricated of two layers of 6-mil polyethylene.

    c. Provide showerhead and controls.

    d. Provide temporary extensions of existing hot and cold water and drainage, as necessary for a complete and operable shower.

e. Provide a soap dish and a continuously adequate supply of soap and maintain in sanitary condition.

f. Arrange so that water from showering does not splash into the Changing or Equipment Rooms.

g. Arrange water shut off and drain pump operation controls so that a single individual can shower without assistance from either inside or outside of the Work Area.

h. Provide flexible hose shower head.

i. Pump waste water to drain or to storage for use in amended water. If pumped to drain, provide 20 micron and 5 micron wastewater filters in line to drain or waste water storage. Change filters daily or more often if necessary. Locate filters inside shower unit so that water lost during filter changes is caught by shower pan.

j. Provide hose bib.

4. Equipment Room (contaminated area): Require work equipment, footwear and additional contaminated work clothing to be left here. This is a change and transit area for workers.

a. Separate this room from the rest of the building with airtight walls fabricated of two layers of 6-mil polyethylene.

b. Provide a drop cloth layer of sheet plastic on floor in the Equipment Room for every shift change expected. Roll drop cloth layer of plastic from Equipment Room into Work Area after each shift change. Replace before next shift change. Provide a minimum of two (2) layers of plastic at all times. Use only clear plastic to cover floors.

B. Equipment Decontamination Unit:

1 Provide an Equipment Decontamination Unit consisting of a serial arrangement of rooms, Clean Room, Holding Room, Wash Room for removal of equipment and material from Work Area. Do not allow personnel to enter or exit Work Area through Equipment Decontamination Unit.

2. Wash Down Station: Provide an enclosed Shower Unit located in Work Area just outside Wash Room as an equipment, bag and container cleaning station.

a. Fabricate waterproof floor extending 6'.0" beyond Wash Down station in all directions. Install seamless waterproof membrane over area and extend over curbs on all four sides. Form curbs from 2" x 4" lumber laid on the flat.

b. Waterproof membrane shall be fabricated from elastomeric membrane or 10 mil polyethylene, minimum.

c. Do not allow water to collect on waterproof membrane. Remove continuously with a wet vacuum or mops.

3. Wash Room: Provide washroom for cleaning of bagged or containerized asbestos-containing waste materials passed from the Work Area.

    a. Construct wash room of nominal 2" x 4" wood framing and polyethylene sheeting, at least 6 mil in thickness and located so that packaged materials, after being wiped clean, can be passed to the Holding Room.

    b. Separate this room from the Work Area by a single flapped door of 6-mil polyethylene sheeting.

    c. Provide a drop cloth layer of plastic on floor in the Wash Room for every load-out operation. Roll this drop cloth layer of plastic from Wash Room into Work Area after each load-out. Provide a minimum of two (2) layers of plastic at all times. Use only clear plastic to cover floors.

4. Airlock: Provide an airlock (4' minimum) between Wash Room and Holding Room. This is a transit area.

    a. Separate this room from adjacent spaces by a sheet plastic flapped doorway.

    b. Separate this room from the rest of the building and adjacent spaces with airtight walls fabricated of two layers of 6-mil polyethylene.

5. Holding Room: Provide Holding Room as a drop location for bagged asbestos-containing materials passed from the Wash Room. Construct Holding Room of nominal 2" x 4" wood framing and polyethylene sheeting, at least 6 mil in thickness and located so that bagged materials cannot be passed from the Wash Room through the Holding Room to the Clean Room.

    a. Separate this room from the adjacent rooms by flap doors fabricated from 6-mil sheet plastic.

6. Airlock: Provide an airlock (4' minimum) between Holding Room and Clean Room. This is a transit area.

    a. Separate this room from adjacent spaces by a sheet plastic flap doorway.

    b. Separate this room from the rest of the building and adjacent spaces with airtight walls fabricated of two layers of 6-mil polyethylene.

7. Clean Room: Provide Clean Room to isolate the Holding Room from the building exterior. If possible locate to provide direct access to the Holding Room from the building exterior.

    a. Erect Critical and Primary Barriers as described herein in an existing space. If no space exists construct Clean Room of 2"x 4" wood framing and polyethylene sheeting, at least 6 mil in thickness.

    b. Separate this room from the exterior by a single flap door of 6-mil polyethylene sheeting.

8. Load-out Area: The load-out area is the transfer area from the building to a truck or dumpster. It may be the Clean Room of the Equipment Decontamination unit or a separate room or loading dock area. Erect Critical and Primary barriers as described in Part 3.1 in load-out area.

    a. During transfer of material from load-out area erect primary barriers as described in Part 3.1 as necessary to seal path from load-out area to truck or dumpster.

C. Decontamination Sequence: Take equipment or material from the Work Area through the Equipment Decontamination Unit according to the following procedure:

1. At wash down station, thoroughly wet clean contaminated equipment or sealed polyethylene bags and pass into Wash Room.

2. When passing equipment or containers into the Wash Room, close doorways of the Equipment Decontamination Unit, other than the doorway between the Wash down Station and the Wash Room. Keep outside personnel clear of the Equipment Decontamination Unit.

3. Once inside the washroom, wet clean the bags and/or equipment.

4. When cleaning is complete pass items into Holding Room. Close doorways except the doorway between the Holding room and the Clean Room.

5. Workers from the building exterior enter Holding Area and remove decontaminated equipment and/or containers for disposal.

6. Require these workers to wear full protective clothing and appropriate respiratory protection.

7. At no time is a worker from an uncontaminated area to enter the enclosure when a removal worker is inside.

D. Construction of the Decontamination Units:

1. Walls and Ceiling: Construct airtight walls and ceiling using 2 layers (minimum) of polyethylene sheeting, at least 6 mil in thickness. Attach to existing building components or a temporary framework.

2. Floors: Use 2 layers (minimum) of 6-mil polyethylene sheeting to cover floors in all areas of the Decontamination Units. Use only clear plastic to cover floors.

3. Flap Doors: Fabricated from three (3) overlapping sheets with openings a minimum of three feet (3') wide. Configure so that sheeting overlaps adjacent surfaces. Weigh sheets at bottoms as required so that they quickly close after being released. Put arrows on sheets to indicate direction of overlap and/or travel.

Provide a minimum of six feet (6') between entrance and exit of any room. Provide a minimum of three feet (3') between doors to airlocks.

a. If the Decontamination area is located within an area containing friable asbestos on overhead ceilings, ducts, piping, etc., provide the area with a minimum 1/4 inch hardboard or 1/2 inch plywood "ceiling" with 2 layers, minimum, polyethylene sheeting, at least 6 mil in thickness covering the top of the "ceiling".

4. Visual Barrier: Where the Decontamination area is immediately adjacent to and within view of occupied areas, provide a visual barrier of opaque polyethylene sheeting at least 6 mil in thickness so that worker privacy is maintained and work procedures are not visible to building occupants. Where the area adjacent to the Decontamination area is accessible to the public, construct a solid barrier on the public side of the sheeting to protect the sheeting. Construct barrier with wood or metal studs covered with minimum 1/4-inch thick hardboard or 1/2-inch plywood. Where the solid barrier is provided, sheeting need not be opaque.

b. Alternate methods of providing Decontamination facilities may be submitted to the Engineer for approval. Do not proceed with any such method(s) without written authorization of the Engineer.

5. Electrical: Provide sub panel at Changing Room to accommodate removal equipment. Power sub panel directly from a building electrical panel. Connect electrical branch circuits in Decontamination unit and particularly any pumps in shower room to a ground-fault circuit protection device.

E. Cleaning of Decontamination Units: Clean debris and residue from inside of Decontamination Units on a daily basis or as otherwise indicated on Contract Drawings. Damp wipe or hose down all surfaces after each shift change. Clean debris from shower pans on a daily basis.

F. Signs:

1. Post an approximately 20 inch by 14 inch manufactured caution sign at each entrance to the Work Area displaying the following legend with letter sizes and styles of a visibility required by 29 CFR 1926.1101.

LEGEND

DANGER

ASBESTOS

CANCER AND LUNG DISEASE HAZARD
RESPIRATORS AND PROTECTIVE CLOTHING ARE REQUIRED

IN THIS AREA

a. Provide signs in both English and Spanish.

b. Provide spacing between respective lines at least equal to the height of the respective upper line.

2. Post an approximately 10 inch by 14 inch manufactured sign at each entrance to each Work Area displaying the following legend with letter sizes and styles of a visibility at least equal to the following:

LEGEND	NOTATION
NO FOOD, BEVERAGES OR TOBACCO PERMITTED	3/4" Block
ALL PERSONS SHALL DON PROTECTIVE CLOTHING (COVERINGS) BEFORE ENTERING THE WORK AREA	3/4" Block
ALL PERSONS SHALL SHOWER IMMEDIATELY AFTER LEAVING WORK AREA AND BEFORE ENTERING THE CHANGING AREA	3/4" Block

3.5 ASBESTOS REMOVAL

A. Pre-work inspection

1. Do not begin any work in any abatement work area until the Owner's Inspection and Testing Agency has performed a pre-work inspection. It is the Contractor's responsibility to notify the Owner of their schedule and anticipated dates for the pre-work inspection.

2. Inspection will be performed to assure all work area preparations are in place, as described herein. Any deficiencies in work area preparations will be corrected at this time. Work may not proceed until the Contractor receives written authorization from the on-site representative of the Testing Agency.

B. Wet Removal:

1. Thoroughly wet Asbestos-Containing Materials to be removed prior to stripping to reduce fiber dispersal into the air. Accomplish wetting by a fine spray (mist) of amended water or removal encapsulant. Saturate material sufficiently to wet to the substrate without causing excess dripping. Allow time for amended water or removal encapsulant to penetrate material thoroughly. If amended water is used, spray material repeatedly during the work process to maintain a continuously wet

condition. If a removal encapsulant is used, apply in strict accordance with manufacturer's written instructions.

2. Mist work area continuously with amended water whenever necessary to reduce airborne fiber levels.

3. Remove intact, saturated Asbestos-Containing Material in small sections from all areas. Do not allow material to dry out. Lower ACM to ground—do not drop ACM from any height. As it is removed, simultaneously package material while still wet into disposal bags or other appropriate waste container. Twist neck of bags, bend over and seal with minimum three wraps of duct tape.

4. Evacuate air from disposal bags with a HEPA filtered vacuum cleaner before sealing.

C. Clean substrate from which ACM was removed by wet wiping and using a HEPA vacuum until no visible debris remains.

D. Encapsulation of Substrate: Perform encapsulation of substrate to lockdown any nonvisible fibers that may be remaining.

3.6 WORK AREA DECONTAMINATION

A. General: Decontamination of the Work Area following asbestos abatement.

1. If the asbestos abatement work is on damaged or friable materials the work is a three-step procedure with two cleanings of the Primary Barrier plastic prior to its removal and one cleaning of the room surfaces to remove any new or existing contamination. Unless specifically indicated otherwise all materials are considered damaged or friable for purposes of this section.

2. If the asbestos abatement work is on undamaged, nonfriable materials that have not been rendered friable, the decontamination procedure is a two-step procedure with two cleanings of the Primary Barrier plastic to remove contamination, thus preventing contamination of the building when the Work Area isolation barriers are removed.

3. In both cases operation of the pressure differential system is used to remove airborne fibers generated by the abatement work.

B. Start of Work: Work of this part begins with the cleaning of the Primary Barrier. At start of work the following will be in place:

1. Primary Barrier: Two layers of polyethylene sheeting on floor and one layer on walls.

2. Critical Barrier: An airtight barrier between the Work Area and other portions of the building or the outside.

3. Critical Barrier Sheeting: Over lighting fixtures and clocks, ventilation openings, doorways, convectors, speakers and other openings.

4. Decontamination Units: For personnel and equipment in operating condition.

5. Pressure Differential System: In operation.

C. First Cleaning: Carry out a first cleaning of all surfaces of the work area including items of remaining sheeting, tools, scaffolding and/or staging by use of damp-cleaning and mopping, and/or a High Efficiency Particulate Air (HEPA) filtered vacuum. (Note: A HEPA vacuum may fail if used with wet material.) Do not perform dry dusting or dry sweeping. Use each surface of a cleaning cloth one time only and then dispose of as contaminated waste. Continue this cleaning until there is no visible debris from removed materials or residue on plastic sheeting or other surfaces.

D. Remove Filters in Air Handling System(s) and dispose of as asbestos-containing waste in accordance with requirements of Part 3.08 of this Section.

E. Wait 96 air changes to allow HEPA filtered fan units to clean air of airborne asbestos fibers. Use oscillating fans as necessary to assure circulation of air in all parts of work areas during this period. Maintain Pressure Differential System in operation for the entire 96-air change period.

F. Second Cleaning: Carry out a second cleaning of all surfaces in the work area in the same manner as the first cleaning.

G. Encapsulation of substrate: Perform encapsulation of substrate at this time. Maintain Pressure Differential System in operation during encapsulation work. Perform work only after meeting the following requirements:

1. Surfaces to be covered have met the requirements for a visual inspection in this section.

2. Airborne fiber counts in the Work Area are at or below 0.01 fibers per cubic centimeter as measured by phase contrast microscopy.

H. Removal of Primary Barriers: Immediately following the second cleaning of the Primary plastic, remove Primary Barrier sheeting and Material Decontamination Unit, if there is one, leaving only:

1. Critical Barrier: Which forms the sole barrier between the Work Area and other portions of the building or the outside.

2. Critical Barrier Sheeting: Over lighting fixtures and clocks, ventilation openings, doorways, convectors, speakers, and other openings.

3. Decontamination Unit: For personnel, in operating condition.

4. Pressure Differential System: Maintain in continuous operation.

I. Final cleaning: Carry out a final cleaning of all surfaces in the work area in the same manner as the first cleaning immediately after removal of Primary plastic. This cleaning is now being applied to existing room surfaces. Take care to avoid watermarks or other damage to surfaces.

J. Contractor's Testing: At the completion of the above cleaning visually inspect all surfaces. Reclean if any dust, debris, etc. is found. At completion of this inspection sweep entire Work Area including walls, ceilings, ledges, floors and other surfaces in the Work Area with exhaust from forced-air equipment (leaf blower with approximately 1 horsepower electric motor or equivalent). Do not direct forced-air equipment at any seal in any Critical Barrier. If any debris or dust is found repeat the cleaning. Continue this process until no debris dust or other material is found while sweeping of all surfaces with forced-air equipment.

K. Wait 48 air changes to allow HEPA filtered fan units to clean air of airborne asbestos fibers. Use oscillating fans as necessary to assure circulation of air in all parts of work areas during this period. Maintain pressure differential system in operation for the entire 48-air change period.

L. After final cleaning perform a complete visual inspection of the entire Work Area including: all surfaces, ceiling, walls, floor, decontamination unit, plastic sheeting, seals over ventilation openings, doorways, windows, and other openings; look for debris from any sources, residue on surfaces, dust or other matter. During visual inspection sweep entire work area including walls, ceilings, ledges, floors, and other surfaces in the room with exhaust from forced air equipment (leaf blower with approximately 1 horsepower electric motor or equivalent). If any debris, residue, dust or other matter is found repeat final cleaning and continue decontamination procedure from that point. When the area is visually clean, and if after sweeping of all surfaces with leaf blower, no debris, residue, dust or other material is found, complete the certification at the end of this section. Visual inspection is not complete until confirmed in writing, on the certification, by Project Administrator.

M. Temporary Lighting: Provide a minimum of 100-foot candles of lighting on all surfaces in the areas to be subjected to visual inspection. Provide hand held lights providing 150-foot candles at 4 feet capable of reaching all locations in work area.

N. Final Air Sampling PCM:

1. After the work area is found to be visually clean, air samples will be taken and analyzed in accordance with the procedure for PCM, as applicable, set forth in Article 1.10 of this Section.

2. If Release Criteria are not met, repeat Final Cleaning and continue Decontamination Procedure from that point. Contractor will bare cost for additional air testing if first set fails.

3. If Release Criteria are met, proceed to work of this Section on Removal of Work Area Isolation.

O. Encapsulation of Substrate: Perform encapsulation of substrate or installation of spray-applied finishes or fireproofing, where required, before Removal of Work Area Isolation as specified below. Maintain Pressure Differential System in operation during encapsulation work.

3.7 DISPOSAL OF ASBESTOS WASTE

A. Disposal Bags or Polyethylene Sheet Wrapping: Provide 12 mil thick, in total, leak-tight polyethylene bags or sheet wrapping, to contain all waste. On outermost layer, apply three labels with text as follows:

1. First Label:

CAUTION
CONTAINS ASBESTOS FIBERS
AVOID OPENING OR BREAKING CONTAINER
BREATHING ASBESTOS IS HAZARDOUS TO YOUR HEALTH

2. Second Label: Provide in accordance with 29 CFR 1910.1200(f) of OSHA's Hazard Communication standard:

DANGER
CONTAINS ASBESTOS FIBERS
AVOID CREATING DUST
CANCER AND LUNG DISEASE HAZARD
BREATHING AIRBORNE ASBESTOS, TREMOLITE, ANTHOPHYLLITE, OR ACTINOLITE FIBERS IS HAZARDOUS TO YOUR HEALTH

3. Third Label: Provide in accordance with U.S. Department of Transportation regulation on hazardous waste marking. 49 CFR parts 171 and 172. Hazardous Substances: Final Rule. Published November 21, 1986 and revised February 17, 1987:

RQ HAZARDOUS
SUBSTANCE,
SOLID, NOS,
ORM-E, NA 9188
(ASBESTOS)

4. Fourth Label: Provide in accordance with U.S. Department of Environmental Protection Regulation of the National Emission Standards for Hazardous Air Pollutants 40 CFR Part 61.150(v) Asbestos NESHAP Revision, Final rule published November 20, 1990.

City of Framingham
Goodnow Lane Water Pumping Station
Framingham, Massachusetts

B. Carefully load containerized waste in fully enclosed dumpsters, trucks or other appropriate fully enclosed vehicles for transport. Exercise care before and during transport, to insure that no unauthorized persons have access to the material.

1. Do not store containerized materials outside of the Work Area. Take containers from the Work Area directly to a sealed truck or dumpster.

2. Do not transport disposal bagged materials on open trucks. Label drums with same warning labels as bags. Uncontaminated drums may be reused. Treat drums that have been contaminated as asbestos-containing waste and dispose of in accordance with this specification.

C. Employ a waste hauler with required licenses from state and local authority with jurisdiction to haul the waste form the abatement work.

D. Dispose of waste in a landfill that accepts asbestos waste materials. Advise the landfill operator or processor, at least ten days in advance of transport, of the quantity of material to be delivered. All waste shall be delivered to only **one** landfill.

E. At disposal site unload containerized waste. At a disposal site, sealed plastic bags may be carefully unloaded from the truck. If bags are broken or damaged, return to work site for rebagging. Clean entire truck and contents, as appropriate.

F. Retain receipts from landfill or processor for materials disposed.

G. At completion of hauling and disposal of each load, submit copy of waste shipment record (WSR) and landfill receipt to the Engineer. The WSR must be returned to the Engineer in no more than 35 days.

3.8 REMOVAL OF WORK AREA ISOLATION:

A. Perform work specified in this article only after all requirements of this Section and Work Area Clearance have been met:

B. Remove the Critical Barriers separating the Work Area from the rest of the building. Remove any small quantities of residual material found upon removal of the plastic sheeting with wet wiping, HEPA filtered vacuum cleaners and local area protection. If significant quantities, as determined by the Engineer, are found then the entire area affected shall be decontaminated.

C. Remove equipment, materials, and debris from the work site.

D. Dispose of asbestos-containing waste material as specified in Part 3.7 of this Section.

3.9 SCHEDULE OF REMOVALS

A. Conduct asbestos abatement work as specified in accordance with Project Phasing Requirements.

END OF SECTION

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SECTION 02090

LEAD BASED PAINT REMOVAL AND OFF-SITE MANAGEMENT

PART 1 - GENERAL

1.01 SUMMARY

A. This Section specifies requirements for working with existing materials that have been painted with lead-based paint. Contractor is responsible for compliance with all regulations, as well as specific requirements of this Section, pertaining to the handling and disposal of materials that contain or are contaminated by lead. A licensed deleading contractor does not have to conduct work where LBP is impacted. Rather, the requirements of this Section are intended to ensure that personnel who disturb LBP are properly trained and qualified; use appropriate personal protection; use methods that do not create lead dust, chips, or fume; and properly dispose of generated materials as a hazardous lead waste.

B. At all times, Contractor shall utilize methods that minimize the generation of airborne lead particulate and fume and the dispersal of paint chips, soil, or other material that are covered or contaminated by lead. Contractor shall provide engineering controls and dust control measures, as necessary, to prevent the migration of lead particulate and fume to adjacent areas. Where workers will be exposed to lead, Contractor shall provide all appropriate personal protective equipment as specified herein, by OSHA, and applicable state and local regulations.

C. Related Work Specified in Other Sections:

1. Section 2050 – Demolition

1.02 SUBMITTALS

A. Work Plan: Submit a site specific OSHA written compliance plan before conducting any work that impacts LBP. Plan must include worker orientation plan that at a minimum includes a description of lead hazards and abatement methodologies, a review of worker protection requirements, and the outline of safety procedures.

B. Permits for transport and disposal of debris. Also, submit copies of manifests and receipts acknowledging disposal of all hazardous and non-hazardous waste material from the project showing delivery date, quantity, and appropriate signature of landfill's authorized representative

C. For all work that may cause employee exposure to lead above the OSHA Action Level, provide the following documentation for employees:

1. Copies of medical records, including lead blood level monitoring data and a notarized statement by the examining medical doctor that such examinations took place, and when, for employees to be used on the project.

2. Record of successful respirator fit testing performed by a qualified individual within the previous six months, for each employee to be used on this project with the employee's name and social security number with each record;

3. Proposed respiratory protection program for employees throughout all phases of the job, including make, model and NIOSH approval numbers of respirators to be used; if applicable.

4. If exposure monitoring or historic data has determined that employees will not be exposed to lead above the OSHA action level, the above requirements are not necessary. If personal samples are collected, submit results to Owner's representative in a timely manner.

1.03 QUALITY ASSURANCE

A. Coordinate work which may disturb surfaces coated with lead-based paint among the trades and with the Owner, so that Work is performed in the proper sequence to minimize disturbance of lead-based paint and to protect other trades

B. The Contractor shall be responsible for the following precautions:

1. Take care to prevent unqualified personnel from disturbing the existing lead-based paint.

2. The Contractor shall be responsible for apprising all other workers, supervisory personnel, subcontractors and consultants who will be at the job site of the hazard and of proper procedures, and shall be responsible for enforcing proper procedures.

1.04 EXISTING CONDITIONS

A. Lead is present in paints at the site in varying contents. The highest concentrations (i.e. 1.0 mg/cm^2 or greater) are present on the following:

Results of Testing for Lead-Based Paint Edgell Road Water Pumping Station				
Location	**Substrate**	**Color**	**Component**	**Approx. Quantity**
Interior – main pump room	Porcelain	White	White Bubbler	1 each

B. THE CONDITION OF LOCATIONS AND SUBSTRATES NOT SPECIFICALLY NAMED ABOVE IS UNKNOWN.

1.05 APPLICABLE REGULATIONS

A. The following may be applicable State and Federal regulations for the project:

1. Occupational Safety and Health Administration
   a. 29 CFR 1910: General Industry Standards
   b. 29 CFR 1910.1025: Lead Standard for General Industry
   c. 29 CFR 1910.134: Respiratory Protection
   d. 29 CFR 1910.1200: Hazard Communication
   e. 29 CFR 1926: Construction Industry Standards
   f. 29 CFR 1926.62: Construction Industry Lead Standard

2. Commonwealth of Massachusetts
   a. 454 CMR 22.00, Massachusetts Department of Safety
   b. 310 CMR Parts 19 and 30, Massachusetts Department of Environmental Protection.

B. All regulations by the above and other governing agencies in their most current version are applicable throughout this project. Where there is a conflict between this Specification and the cited federal, state or local regulations or guidelines, the more restrictive or stringent requirements shall prevail. This Section refers to many requirements found in these references, but in no way is it intended to cite or reiterate all provisions therein or elsewhere. It is the contractor's responsibility to know, understand, and abide by all such regulations, guidelines and common practices.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Fire rated polyethylene sheet in a roll size to minimize the frequency of joints shall be delivered to job site with factory label indicating 6 mil.

B. Polyethylene disposable bags shall be six (6) mil with pre-printed label.

C. Tape or adhesive spray will be capable of sealing joints in adjacent polyethylene sheets and for attachment of polyethylene sheet to finished or unfinished surfaces of dissimilar materials and capable of adhering under both dry and wet condition, including use of amended water.

D. Impermeable containers are to be used to receive and retain any lead containing or contaminated materials until disposal at an acceptable disposal site. The containers shall be labeled in accordance with EPA and DOT standards.

E. Machine Sanding Equipment - Sanders shall be of the dual action, rotary action, orbital or straight line system type, fitted with a high efficiency particulate air (HEPA) dust pick-up system.

2.02 TOOLS AND EQUIPMENT

A. Provide suitable tools for all operations related to LBP.

B. The Contractor shall have available sufficient inventory or dated purchase orders for materials necessary for the job including protective clothing, respirators, filter cartridges, 6-mil fire-rated polyethylene sheeting of proper size, tape, and air filters.

C. The Contractor shall have available power cables or sources such as generators (where required).

PART 3 - EXECUTION

3.01 WORK AREA PREPARATION

A. Prior to the commencement of any work that may cause employees to be exposed to an airborne concentration of lead **above the PEL,** the following work area preparation shall be required:

1. Signs warning of the potential exposure to lead shall be posted. The signs shall have the following designation:

WARNING:
LEAD WORK AREA
POISON
NO SMOKING OR EATING

2. Decontamination Area. At a minimum, the Contractor shall construct a change area with attached shower (hand-washing facilities may be used in lieu of showers during the period that the contractor is conducting initial monitoring to determine worker exposure to airborne lead). This decontamination area shall be directly adjacent to the work area for the decontamination of workers contaminated with lead. The contractor shall ensure that employees use the worker decontamination area prior to leaving the work area. The decontamination area shall be constructed with six-mil polyethylene sheeting on floors, walls and ceiling.

3. The work area boundary shall be defined by caution tape supplemented by appropriate warning signs. For **interior** work areas, all openings to the work area shall be covered with two layers of 6-mil polyethylene and sealed with duct tape. A decontamination unit, consisting of change area and shower, shall be installed at the entrance to the work area.

B. The Contractor shall maintain tarps/polyethylene barriers, and a clean area as long as needed for the safe and proper completion of the work. Any openings or tears in

the work area barriers shall be corrected by the Contractor at the beginning of each work day. Work will not be allowed to commence until all barriers are in place and acceptable to the consultant.

3.02 PERSONAL AIR MONITORING

A. General: The contractor is required to perform personal air monitoring in accordance with OSHA standards during all work involving a potential exposure to airborne lead. The results of such sampling shall be posted, provided to individual workers, and submitted to Owner and consultant as described herein.

1. In lieu of monitoring, Contractor may use historical data from previous projects in accordance with the criteria outlined in 29 CFR Part 1926.62 (d).

B. Sampling: Samples shall be taken for the duration of the work shift or for eight hours, whichever is less. Personal samples need not be taken every day after the first day if working conditions remain unchanged, but must be taken every time there is a change in the removal operation, either in terms of the location or the type of work. Sampling will be used to determine eight-hour Time-weighted Averages (TWA). The Contractor is responsible for personal sampling as outlined in OSHA Standard 29 CFR 1926.62. This sampling will determine the degree of respirator protection required, subject to the regulations.

C. Sampling Results: Air sampling results shall be transmitted to the Owner and individual workers in written from no more than forty-eight (48) hours after the completion of a sampling cycle. The reporting document shall list each sample's result, sampling time and date, personnel monitored and their social security numbers, flow rate, sample duration, sample yield, cassette size, and analysts" name and company, and shall include an interpretation of the results. Air sample analysis results shall re reported in micrograms of lead per cubic meter of air (μ/m^3).

D. Air Monitoring Frequency. The air monitoring frequency for Contractor operations will be established in accordance with the requirements set forth in 29 CFR 1926.62

3.03 WORKER PROTECTION REQUIREMENTS

A. Biological Monitoring: The contractor shall be responsible for medical surveillance and record keeping, as defined in the OSHA Lead in Construction Standard (29 CFR 1926.62) and Local Law. In addition, contractor shall have a medical examination performed on each employee if exposure is above the OSHA Action Level. This medical examination must be performed before workers begin lead contaminated work area and at the termination of an employee's employment or yearly, whichever comes first.

B. Training Requirements: All workers shall be trained about the exposures to lead hazards at a minimum to the requirements of OSHA regulation 29 CFR 1926.62.

C. Respirators and Personal Protective Equipment (PPE):

1. Personal protection in the form of disposable coveralls and NIOSH and MSHA approved respirators, is required for all workers, supervisors, and authorized visitors entering the work area during operations that generate airborne lead.

2. Provide a clean area for workers to put on suits and other personal protective equipment and to store their street clothes.. In addition to disposable suits for the workers, the Contractor shall also supply suits for the Consultant and other personnel who are authorized to inspect the work site. Contractor must consider this cost in the bid. Disposable suits, such as TYVEK suits, and other personal protective equipment (PPE) must be donned prior to entering work area. Light weight nylon clothes may be worn under the suit, but these clothes must be changed before leaving the work area and should be laundered separately.

3. Supply workers and supervisory personnel with NIOSH and MSHA approved respirators and HEPA filters. Respiratory protection shall be implemented for all work performed by the Contractor under this Section. The respirators shall be sanitized and maintained according to the manufacturer's specifications. Disposable respirators shall not be considered acceptable under any circumstances. The Contractor shall maintain on-site a sufficient supply of HEPA filters to allow workers and supervisory personnel to change contaminated filters per manufacturer's recommendations or when breathing resistance is encountered. The Contractor is solely responsible for means and methods used and for compliance with applicable regulations:

4. Respirators shall be individually assigned to workers for their exclusive use. All respiratory protection shall be provided to workers in accordance with the approved respiratory protection program, which includes all items in OSHA 29 CFR 1910.134 (B), (D), (E) & (F).

3.04 REMOVAL OF LOOSE PAINT AND PAINT CHIPS

A. The Contractor shall remove all loose paint chips from all known LBP surfaces. Contractor shall utilize power wash and HEPA vacuums to clean all loose LBP from walls, columns, beams, mechanical equipment, floors, widows, doors, etc. All loose paint chips shall be properly packaged for disposal as a hazardous lead waste.

B. Contractor is responsible for all demolition activities required to access and remove doors and windows, such as masonry, plaster, wood, etc.

3.05 DISPOSAL OF WASTE MATERIAL

A. All materials, whether hazardous or non-hazardous, shall be disposed of in accordance with all laws and the provisions of this Section and any or all applicable federal, state, county, or local regulations and guidelines. It shall be the sole responsibility of the Contractor to assure compliance with all laws and regulations relating to this disposal. The requirements of the Resource Conservation and Recovery Act (RCRA) must be

complied with, as well as any or all other applicable federal, state, county, or local waste requirements.

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SECTION 02100

SITE PREPARATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Requirements for removal of vegetation and topsoil at the site.

1.02 DEFINITIONS

A. Clearing: Removal of trash, vegetation, or organic matter alive or dead.

B. Grubbing: Removal of vegetation including stumps, buried logs and roots.

C. Scalping: Removal of grass turf to a depth of 3 inches.

D. Stripping: Removal of top soil after scalping operation is complete.

1.03 QUALITY ASSURANCE

A. Obtain Engineer's approval of staked work limits prior to starting the clearing, grubbing, and stripping.

1.04 PROJECT/SITE CONDITIONS

A. Environmental Requirements

1. Install erosion and sediment controls as necessary prior to starting the Work.

B. Existing Conditions

1. Temporarily remove property improvements, to the minimum extent necessary, to complete the work and restore improvements to condition which existed prior to construction.

PART 2 PRODUCTS

2.01 EXISTING PRODUCTS

A. Chips from cleared trees and brush.

PART 3 EXECUTION

3.01 PROTECTION

A. Do not cut or injure any trees or other vegetation outside the limits of disturbance and/or permanent easement, as indicated on the drawings.

B. Trees, shrubbery, or planting, along the traveled highways or roads, shall not be removed except with the written approval of the Engineer.

C. Preserve certain vegetation such as trees, shrubs, hedges and plants within the construction area, as indicated on the drawings to be protected.

D. Easement Clearing

1. The Engineer shall designate trees to be removed within easement lines.

E. Work In Improved Property

1. Protect trees, cultivated hedges, lawns, shrubs, and plants that might be damaged by the Contractor's operations.
2. Temporarily replant and care for trees less than 4 inches in diameter that would be damaged by the construction operation. After the construction operations have been substantially completed, replant in their original positions and care for until growth is reestablished. If trees, cultivated hedges, lawns, shrubs, and plants are injured to such a degree as to affect their growth or diminish their beauty or usefulness, they shall be replaced at the Contractor's expense by items of kind and quality existing at the start of the work.
3. Do such handwork as may be required to prevent damage to buildings and improvements.
4. Protect fences and stone walls and if needed to be removed to facilitate construction or if damaged, upon completion of the work, properly restore or repair to at least as good condition as existed prior to start of the work.

3.02 CLEARING

A. Cut or remove all trees, saplings, brush, and vines, windfalls, logs, and trees lying on the ground, dead trees and stubs more than 1 foot high above the ground surface.

B. Except where clearing is done by uprooting with machinery or where stumps are left longer to facilitate subsequent grubbing operations, trees, stumps, and the stubs to be cleared shall be cut as close to the ground surface as practicable, but no more than 6-inches above the ground surface in the case of small trees, and 12-inches in the case of larger trees. Saplings, brush, and vines shall be cut off close to the ground.

C. Selective Trimming

1. Cut back limbs and branches of trees to be preserved only to the extent necessary for construction.
2. Trim neatly, and cleanly so that the remaining tree will not be damaged and healing will be facilitated. Where limbs and branches over 1 inch in diameter have been cut, the newly cut area of the tree shall be given a thorough application of approved tree-healing paint.

D. Salvaged Wood

1. Logs, timber and other wood removed in the course of clearing found to be acceptable, as determined solely by the Engineer, shall remain the property of the applicable private property owner or the Owner, unless otherwise directed by the Engineer.
2. Cut logs, timber and other wood in 4 foot lengths and stack, as directed by the Engineer.
3. Prior to the final completion of the contract, all unclaimed logs, timber and other wood previously cut and stacked shall be removed from the site and properly disposed of by the Contractor at no additional cost to the Owner.

E. Chips from Cleared Wood and Brush

1. Stockpile for future use on cleared easements as indicated on the Drawings.
2. Spread at locations shown on the drawings once work is substantially complete.
3. If the wood chips from the cleared wood are not of sufficient amount, the Contractor at his own expense shall furnish the required amount to provide a minimum thickness as shown on the Contract Drawings.
4. Elm wood and elm bark shall not be used as chips for ground cover.

3.03 GRUBBING

A. Remove completely all stumps.

B. Remove to a depth of 12-inches all roots larger than 3-inches in diameter.

C. Remove to a depth of 6-inches all roots larger than 1/2-inches in diameter.

D. Measure depths from the existing ground surface or the proposed finished grade, whichever is the lower.

3.04 STRIPPING

A. Strip topsoil, loam and unsuitable earth from the ground surface in areas cleared and grubbed.

B. Utilize topsoil and loam, where possible, for finished surfacing.

C. All loam to remain on site.

D. Dispose of unsuitable materials off site at authorized disposal location.

3.05 DISPOSAL OF CLEARED AND GRUBBED MATERIALS

A. Dispose of cleared and grubbed materials off site at authorized disposal location.

B. Such disposal shall be carried on as promptly as possible after removal of material in the clearing and grubbing operations and shall not be left until the final period of cleaning up.

C. Elm bark whether stripped from the wood or intact with the wood shall be either buried at least 1 ft. below grade in approved dumping areas or burned in a suitable incinerator off-site with satisfactory anti pollution and fire prevention controls to prevent the spread of Dutch Elm Disease.

END OF SECTION

SECTION 02140

DEWATERING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.02 DESCRIPTION

A. Dewatering consists of the removal of surface water and groundwater as necessary to perform the construction required by the contract in accordance with the drawings and specifications. Furnish all labor, materials, equipment, and incidentals required to:

1. Design, furnish, operate, maintain, and remove temporary dewatering systems to control groundwater and surface water to maintain stable, undisturbed subgrades, and allow work to be performed under dry and stable conditions, and comply with all applicable permit and other regulatory requirements.
2. Work to be done as part of dewatering includes, but is not limited to:
    a. Work in areas where excavation to depth below the groundwater water level is required. This includes but is not limited to the installation of water main below existing drain lines, the installation of drainage piping and structures, and the installation of sewer structures and piping.
    b. Lower hydrostatic pressure.
    c. Prevent surface water from entering the excavation during construction.
    d. Implement erosion and sedimentation control measures.
    e. Provide system to treat/settle all water removed from excavations, except water that is re-infiltrated into the ground on site in a manner that does not result in negative on- or off-site impacts.
    f. Provide an Environmental Site Professional/Dewatering Specialist/Field Representative (hereinafter referred to as the Dewatering Professional) who will be responsible for dewatering, reinfiltration, treatment and discharge of dewatering flows as specified and in compliance with all applicable permits and regulations.

3. Clean, uncontaminated groundwater or accumulated surface runoff removed from excavations shall be reinfiltrated to the ground if feasible, by means of a temporary infiltration trench or basin. The temporary infiltration trench or basin must be: 1) open to the surface or "open-air"; and 2) wider than it is deep. Otherwise, the Contractor must obtain an Underground Injection Control (UIC) permit from the Massachusetts Department of Environmental Protection (MassDEP) Bureau of Resource Protection (BRP) in accordance with 310 CMR 27.00.

   Surface flow that could lead to offsite discharge is not permitted. If reinfiltration is not feasible, treated water shall be directly or indirectly discharged to a surface water in accordance with a National Pollutant Discharge Elimination System (NPDES) permit issued by the U.S. Environmental Protection Agency (EPA). If neither reinfiltration nor surface water discharge is feasible, treated water shall be discharged to the local sewer system in accordance with the appropriate permits and regulations or transported off-site to an approved facility. In no case shall dewatering flows be directly or indirectly released to surface waters or storm drains prior to settling and appropriate additional treatment. The Contractor is responsible for acquiring all the proper permitting required for the chosen method of discharge.

4. If work is expected to be conducted within soil or groundwater affected by oil or hazardous materials, or if the groundwater appears to be impacted, prior to any discharge, the groundwater or accumulated surface runoff shall be sampled and tested to meet the requirements of the NPDES Remediation General Permit (Appendix III), or other permit requirements if an alternative discharge/disposal method (e.g., discharge to sanitary sewer, off-site disposal) is selected by the Contractor. The Contractor is responsible for coordinating the selected method of permitting and discharge or disposal with the Owner's Licensed Site Professional (LSP) to meet the applicable requirements of the Massachusetts Contingency at 310 CMR 40.00. Laboratory analysis of groundwater to be treated and discharged may include, but not be limited to, the following parameters:

   a. RCRA 8 Metals, US EPA Methods 6010B and 6020;

   b. Volatile Organic Compound (VOC), US EPA Method 8260B;

   c. Semi Volatile Organic Compound (SVOC), US EPA Method 8270C;

   d. Pesticides, US EPA Method 8081

   e. Herbicides, US EPA Method 8151A

   f. Corrosivity/Toxicity, US EPA Method 9040B and 9045C;

   g. Reactivity, US EPA Method 7.3;

   h. pH and

   i. Ignitability, US EPA Method 1010

   Upon sampling, testing and characterization of the groundwater or accumulated surface runoff, proper treatment or disposal of the impacted ground water or accumulated surface runoff shall be determined. Treatment, discharge or disposal

of impacted groundwater shall be in accordance with all applicable regulations and shall be approved by the Engineer and Owner prior to final discharge or disposal.

5. Related Sections:

    a. Section 02200 – Earth Excavation, Backfill, Fill, and Grading

1.03 SUBMITTALS

A. Shop Drawing: Submit the following in accordance with Article 6.17 of the General Conditions and Section 01300 – Submittals:

1. Qualifications of the both the Contractor's dewatering specialist or firm (design) and the Dewatering Professional (all other responsibilities) shall be submitted for approval a minimum of four (4) weeks prior to execution of any dewatering. The submittal shall include, but not be limited to:

    a. Qualifications of firm's Registered Professional Engineer as specified in Section 1.04, B.

    b. Qualifications of the Dewatering Professional who shall oversee the installation, operation and maintenance of the dewatering system.

2. Submit a Dewatering Plan including design calculations at least four (4) weeks prior to start of any dewatering operation. The submittal will be only for the information of the Owner and third parties for an overall understanding of the project relating to access, maintenance of existing facilities and proper utilization of the site. The Contractor shall remain responsible for the adequacy, regulatory compliance, and safety of the means, methods and sequencing of construction activities related to dewatering. The plan shall include the following items as a minimum:

    a. Dewatering Plan and details stamped and signed by a Massachusetts Registered Professional Engineer that conforms to the requirements of the dewatering permit(s), the Wetlands Protection Act Order of Conditions, and all other applicable regulations and permits including, but not limited to, requirements for equipment, monitoring, sampling and reporting.

    b. A list of equipment including, but not limited to, pumps, prime movers, and standby equipment.

    c. A description of the proposed method of dewatering; water reinfiltration; containment; treatment discharge; and disposal; and installation, maintenance, and system removal procedures.

    d. A description of erosion/sedimentation control measures and best management practices to eliminate or minimize impacts from potential pollutants.

3. Data for the required discharge reports, as applicable, shall be collected and maintained by the Contractor's Dewatering Professional. It shall consist of periodic sampling and analysis of system influents, midfluents and/or effluents

and discharge quantities and other requirements of the relevant permits. The Contractor's Dewatering Professional shall also coordinate analysis of samples at an appropriately certified analytical laboratory and shall comply with all permit reporting requirements.

4. Contractor shall submit a modified Dewatering Plan **within 24 hours**, if open pumping from sumps and ditches results in boils, loss of fines, softening of the ground or other adverse impacts on or off-site.

1.04 QUALITY ASSURANCE

A. Provide in accordance with Section 01400 – Quality Control and as specified.

B. Employ the services of a Dewatering Professional and a Massachusetts Registered Professional Engineer having the following qualifications:

1. The Massachusetts Registered Professional Civil Engineer shall have completed the design of at least five (5) successful dewatering projects of equal size and complexity and with equal systems within the last five (5) years consisting of deep wells, well points, vacuum well points, and sump pumping for heavy Civil projects of similar size, type, and complexity in developed areas with trench box or steel/timber sheeting support of excavation systems.

2. The dewatering system installer's supervisor shall have a minimum of 5 years experience in installation of well points, deep wells, recharge systems, or equal systems.

3. The Dewatering Professional responsible for day to day operation of the system shall have the following minimum qualifications:

a. Completion of at least 5 successful dewatering projects of equal size and complexity with equal systems within the last five (5) years consisting of system operation and troubleshooting, collection of readings, maintenance of logs and other required documents, collection of samples, coordination of analysis of samples, and compliance with reporting requirements during pumping for heavy Civil projects of similar size, type, and complexity in developed areas.

b. Current certification from MassDEP to operate the proposed treatment system, as applicable.

C. If subgrade soils are disturbed or become unstable due to dewatering operation or an inadequate dewatering system, notify the Engineer, stabilize the subgrade, and modify system to perform as specified at no additional cost to the Owner.

D. If oil and/or other hazardous materials are encountered after dewatering begins, immediately notify the Engineer.

1.05 PROJECT/SITE CONDITIONS

A. Environmental Conditions: Refer to Environmental Assessment Appendix A.

B. Subsurface Investigations: Refer to Boring Logs Appendix B. (Please note that depth to groundwater was observed during the advancement of soil borings. Groundwater levels fluctuate throughout the year and therefore values reported on boring logs may not be representative of groundwater conditions at the time of construction.)

PART 2 - PRODUCTS

2.01 MATERIALS

A. Dewatering equipment shall consist of all equipment specified in the Contractor's approved Dewatering Plan.

B. Provide and store auxiliary dewatering equipment, consisting of pumps and hoses on the site in the event of breakdown, at least one (1) pump for every five (5) used.

C. Provide dewatering equipment, including an appropriately sized settling tank, and maintain erosion/sedimentation control devices as indicated or specified and in accordance with the Dewatering Plan.

D. Provide temporary pipes, hoses, flumes, channels, crushed stone, geotextile fabric, sedimentation barriers, or any combination of the above for the transport of discharge water over-ground to the discharge location.

E. Provide sampling and analysis equipment to test for turbidity.

PART 3 - EXECUTION

3.01 GENERAL

A. Execution of any earth excavation, installation of earth retention systems, and dewatering shall not commence until the related submittals have been submitted, approved by the Owner and Engineer, and the Dewatering Professional is on site and has begun the duties specified herein.

B. Furnish, install, operate, and maintain dewatering, re-infiltration, treatment and discharge systems as indicated or specified and in accordance with the Dewatering Plan. Delays due to insufficient storage capacity, inadequate Contractor Dewatering Plan, or permitting delays will be at no additional cost to the Owner. The Contractor is responsible to evaluate available data and determine the necessary dewatering system so as not to impede construction activities.

C. Carry out dewatering program in such a manner as to prevent undermining or disturbing foundations of existing structures or of work ongoing or previously completed.

D. Do not excavate below the seasonal high groundwater elevation until the dewatering system is operational.

E. Unless otherwise specified, continue dewatering uninterrupted until all structures, pipes, and appurtenances below the seasonal high groundwater level have been completed and sufficiently backfilled and/or anchored such that they will not be floated or otherwise damaged by an increase in groundwater elevation.

F. Discontinue open pumping from sumps and ditches, if such pumping is resulting in boils, loss of fines, softening of the ground, instability of the slopes or other adverse impacts on or off-site. Modify Dewatering Plan and submit to the Engineer at no additional cost to the Owner.

G. Where subgrade materials are disturbed or become unstable due to dewatering operations, remove and replace the materials at no additional cost to the Owner.

3.02 DEWATERING DISCHARGE

A. Groundwater or accumulated surface runoff to be infiltrated does need not be treated, unless known to be contaminated or noticeably impacted with oil or hazardous waste. Contractor shall provide infiltration as described in Section 1.02.A.3 that complies with relevant local, state and federal regulations.

B. The effluent (discharge) shall be tested for turbidity on a daily basis and shall not exceed 280 NTU, averaged over 5 consecutive days. Sufficient measures shall be employed to provide effective ways to remove turbidity, color and potential coliform organisms (from sewer work) prior to discharge

C. Transport pumped or drained water to discharge location in compliance with applicable permits and without interference to other work; damage to or contamination of pavement, other surfaces, or property; erosion; or siltation.

D. Provide separately controlled pumping lines.

E. Immediately notify the Engineer and Owner if groundwater is encountered that is suspected to be contaminated with substances other than those for which the treatment system has been designed. Do not pump water found to be contaminated with oil or other hazardous material to the discharge locations. Sampling, testing and characterization of the groundwater shall include (but not be limited to) criteria within part 1.2 of this specification section to determine the final disposal of the groundwater. Groundwater disposal shall follow all local, state and federal permits and regulations.

3.03 COMPLIANCE WITH DEWATERING AND RELATED PERMITS AND REGULATIONS

A. Discharging groundwater and allowing for natural infiltration may not be a viable option for controlling groundwater in the project area. Should dewatering activities be required where the Contractor needs to discharge groundwater to a location other than the point of origin, then the Contractor shall store, treat and discharge the water in accordance with applicable permits and regulations. Periodic sampling, as may be required to demonstrate treatment effectiveness and compliance with pretreatment

standards specified in any local, state, or federal discharge permit required shall be the responsibility of the Contractor and its Dewatering Professional. If on-site infiltration, discharge to the local sanitary sewer system or off-site disposal are not feasible options, the Contractor shall be responsible for seeking coverage under one of the following EPA NPDES permits: Construction General Permit (CGP) for projects disturbing >1 acre; Dewatering General Permit (DGP) for projects disturbing <1 acre; or Remediation General Permit (RGP) for any project with known groundwater contamination. The Contractor shall be prepared to comply with standard local permit conditions including periodic testing of the effluent and with standard NPDES permit conditions including periodic testing of the treatment system influent, midfluent and effluent. The Dewatering Plan shall include a description of procedures and information related to the collection of readings, maintenance of logs and other required documents. At a minimum, the Dewatering Plan shall describe compliance with relevant provisions of the applicable NPDES Permit or other discharge permit and the local Conservation Commission Order of Conditions. Copies of the applicable NPDES or other permit authorization to discharge shall be provided to the Owner prior to the start of dewatering activities.

B. The Contractor, through its Dewatering Professional:

1. Shall furnish all labor, equipment and materials necessary to obtain accurate representative samples of the groundwater and for analysis for the set of analytical parameters specified above and as required by local, state and federal permits and regulations.
2. Shall coordinate sampling activities with the Engineer. The Engineer reserves the right to sample treated and untreated dewatering flows at any time.
3. Shall take readings from the treatment system in accordance with the Dewatering Plan.
4. Shall collect an initial sample of untreated and treated groundwater at the beginning of dewatering activities within the construction area. Sampling and start-up shall be conducted in accordance with applicable permits.
5. Shall prepare and keep in proper order all records required by regulatory authorities and permits.
6. Shall maintain logs and other records in accordance with the Specifications, regulatory agency and permit requirements, and the Dewatering Plan.
7. Shall coordinate analysis of samples by an appropriately certified analytical laboratory in accordance with the Specifications, regulatory agency and permit requirements, and the Dewatering Plan, and ensure that laboratory detection limits meet permit requirements.
8. Shall comply with reporting requirements in a timely manner and in the format required by the relevant permit. Reporting in compliance with permit requirements includes, but is not limited to: notification to the appropriate regulatory agencies, Owner and Engineer prior to discharge; submittal of laboratory analytical reports for each sampling event; submittal of reports for each reporting period during which no discharge occurs; notification of non-compliant

discharges; notification of termination of discharge; and response to permit-related questions posed by regulatory agencies or the Owner and Engineer.

a. If water will be discharged under a National Pollutant Discharge Elimination System (NPDES) permit, submit notifications and reports to both the Environmental Protection Agency (EPA) and the appropriate regional office of the Massachusetts Department of Environmental Protection (MassDEP) and the Engineer. Comply with pre-discharge notification, discharge reporting, notification of no discharge, and termination of discharge notification requirements; and respond to inquiries or correspondence from EPA or MassDEP regarding permit issues.

b. If water will be discharged under a local permit, submit notifications and reports as required in the permit.

c. Observe and record daily the elevation of the groundwater during the length of the dewatering operation and provide data to Engineer on daily basis. For monthly or less frequent reporting deadlines, provide the Engineer with copies of all reports fourteen (14) days prior to the reporting deadline, and submit reports to the appropriate agency(ies). Provide copies of other dewatering documents to the Engineer immediately.

9. Install and maintain erosion/sedimentation control devices at the point of discharge as indicated or specified and in accordance with the Dewatering Plan.

10. The Contractor shall obtain all federal, state, county, and local permits and variances to allow transport of materials on public roadways, should such transport be necessary.

11. The Contractor shall dispose of all wastes resulting from construction dewatering activities in accordance with local, federal and state regulations.

12. The Contractor is solely responsible for the implementation of the permit requirements, and is solely responsible for any punitive action resulting from any violation of the permit. The actual permit issued shall become part of this Contract by either addendum or by change order. If the actual permit is included by change order, no additional costs for implementing the permit will be considered by the Owner, when the actual permit is issued.

3.04 REMOVAL

A. Do not remove dewatering system without written approval from the Engineer.

B. Backfill and compact sumps or ditches in accordance with Section 02200 – Earth Excavation, Backfill, Fill, and Grading.

C. All dewatering wells shall be abandoned upon completion of the work, and completely backfilled with cement grout.

END OF SECTION 02140

SECTION 02200

EARTH EXCAVATION, BACKFILL, FILL AND GRADING

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes

1. Requirements for; excavating in earth for trenches and structures; backfilling excavations; furnishing necessary material; compaction; constructing embankments and fills; miscellaneous earth excavations and miscellaneous grading.

B. Related Sections

1. Section 01410 – Testing Laboratory Services
2. Section 02080 – Soil and Waste Management
3. Section 02140 - Dewatering
4. Section 02215 - Aggregate Materials
5. Section 03300 - Cast-In-Place Concrete

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM).

1. D1557, Standard Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10-lb. (4.54 kg) Rammer and 18-inch (457 mm) Drop. Wherever a percentage of compaction is indicated or specified, use percent of maximum density at optimum moisture as determined by Procedure C.

1.03 MEASUREMENT AND PAYMENT PROCEDURES

A. Test Pits

1. Test pits are indicated on the Drawings. The cost for these test pits shall be included in the Lump Sum cost for Item No. 1.

1.04 QUALITY ASSURANCE

A. Field Samples

1. Provide samples of materials as requested by the Engineer, to the Quality Control Engineer hired by the Owner, prior to delivery of materials on site, in order to facilitate field testing of compaction operations and material properties.

1.05 PROJECT/SITE CONDITIONS

A. Existing Conditions

1. There are pipes, drains, and other utilities in locations not indicated on drawings, no attempt has been made to show all services, and completeness or accuracy of information given is not guaranteed.

1.06 MAINTENANCE

A. Maintain all work in accordance with SECTION 01800.

PART 2 PRODUCTS

2.01 MATERIALS

A. Suitable Aggregate

1. The nature of materials will govern both acceptability for backfill and methods best suited for placement and compaction.
2. All material whether from excavations or from borrow, after being placed and properly compacted, will make a dense stable fill and containing no vegetation, roots, stones over 6 inches in diameter, or porous matter.
3. Organic matter to be well distributed and not to exceed minor quantities.

B. Trench and Excavation Backfill

1. In general, and unless other material is indicated on drawings or specified, material used for backfilling trenches and excavations shall be suitable material which was removed in the course of making the construction excavations. If sufficient suitable material is not available from the excavations, the backfill material shall be screened gravel, bank-run or selected borrow as directed in according to respective Specification Sections.

C. Structure Backfill

1. Unless otherwise indicated or specified, all fill and backfill under structures and pavement adjacent to structures shall be compacted bank-run gravel containing not more than 10 percent material passing a 200 sieve. When coarse aggregate and fine aggregate are indicated or specified for use under structures, they shall conform to the requirements for coarse and fine aggregate specified in Section 03300.

D. Filling and Embankment Backfill

1. Suitable selected materials available from the excavations and not required for backfill around pipes or against structures may be used for filling and building embankments, except as otherwise specified. Material needed in addition to that available from construction operations shall be obtained from suitable gravel banks or other suitable deposits. The Contractor shall furnish, at his own expense, all borrow material needed on the work.

E. Additional materials

1. Concrete: In accordance with SECTION 03300.
2. Screened gravel: In accordance with SECTION 02215.
3. Bank-run gravel: In accordance with SECTION 02215.
4. Selected borrow: In accordance with SECTION 02215.

2.02 EQUIPMENT

A. Well Points

1. Designed to drain soil and prevent saturated soil from flowing into excavation.

B. Pumping Units

1. Designed for use with the wellpoints, capable of maintaining a high vacuum and, handling large volumes of air and water at the same time.

C. Underdrain Pipe

1. HDPE pipe enclosed in crushed stone encased in filter fabric.
2. Sewer pipe of quality know as "seconds".

2.03 SOURCE QUALITY CONTROL

A. Provide Engineer with access to location of off site sources of materials.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify all existing utilities and facilities prior to excavation.

3.02 PROTECTION

A. Utilities

1. Support and protect from damage existing pipes, poles, wires, fences, curbing, property line markers, and other structures, which the Engineer decides must be preserved in place without being temporarily or permanently relocated.
2. Restore items damaged during construction without compensation, to a condition at least equal prior to construction.

B. Trees

1. Enclose the trunks of trees adjacent to work with substantial wooden boxes of height necessary to protect trees from injury from piled material, equipment, operations or otherwise.
2. Employ excavating machinery and cranes of suitable type and size and operate with care to prevent injury to trees not to be cut and particularly to overhanging branches and limbs.
3. When trimming is required, make all cuts smooth and neat without splitting or crushing.
4. Cover cut areas with an application of grafting wax or tree healing paint.
5. Branches, limbs, and roots shall not be cut except by permission of the Engineer.

C. Plantings

1. Protect by suitable means or temporarily replant and maintain cultivated hedges, shrubs, and plants which may be injured by the Contractor's operations
2. Replant in their original positions and care for until growth is re-established, once the construction operations have been substantially completed.
3. If cultivated hedges, shrubs, and plants are injured to such a degree as to affect their growth or diminish their beauty or usefulness, they shall be replaced by items of kind and quality at least equal to which existed prior to the start of the Work.

D. Paved surfaces

1. Do not use or operate tractors, bulldozers, or other power-operated equipment with treads or wheels shaped as to cut or injure paved surfaces.
2. All surfaces which have been injured by the Contractor's operations shall be restored to a condition at least equal to which existed prior to start of the Work.
3. Suitable materials and methods shall be used for such restoration.

3.03 PREPARATION

A. Pavement Removal

1. Remove only existing pavement as necessary for the prosecution of the work.

2. Engineer may require that pavement be cut with pneumatic tools or saws without extra compensation to Contractor, where in the opinion of the Engineer it is necessary to prevent damage to the remaining road surface.

3. Dispose large of pieces of broken pavement before proceeding with excavation.

B. Top Soil Removal

1. From areas which excavations are to be made, loam and topsoil shall be carefully removed and separately stored to be used again as directed; or, if the Contractor prefers not to separate surface materials, he shall furnish, as directed, loam and topsoil at least equal in quantity and quality to that excavated.

C. Subgrade

1. Remove loam and topsoil, loose vegetable matter, stumps, large roots, etc., from areas where embankments will be built or material will be placed for grading.

2. Shape as indicated on the drawings and prepare by forking, furrowing, or plowing to bond first layer of the new material placed.

3.04 RELOCATION AND REPLACEMENT OF EXISTING STRUCTURES

A. The structures to which the provisions of this article apply include pipes, wires, and other structures which meet all of the following:

1. Are not indicated on the drawings or otherwise provided for.

2. Encroach upon or are encountered near and substantially parallel to the edge of the excavation.

3. In the opinion of the Engineer will impede progress to such an extent that satisfactory construction cannot proceed until they have been changed in location, removed (to be later restored), or replaced.

B. In removing existing pipes or other structures, the Contractor should use care to avoid damage to materials, and the Engineer shall include for payment only those new materials which, in his judgment, are necessary to replace those unavoidably damaged.

C. Whenever the Contractor encounters certain existing structures as described above and is so ordered in writing, he shall do the whole or such portions of the work as he may be directed to change the location of, remove and later restore, or replace such structures, or to assist the Owner thereof in so doing. For all such work, the Contractor shall be paid under such items of work as may be applicable, otherwise as Extra Work.

D. When fences interfere with the Contractor's operations, he shall remove and (unless otherwise specified) later restore them to a condition which existed prior to the start

of the Work, all without additional compensation. The restoration of fences shall be done as promptly as possible and not left until the end of the construction period.

3.05 SHEETING AND BRACING

A. Furnish, put in place, and maintain such sheeting, bracing, etc., as necessary to support the sides of the excavation and to prevent any movement of earth which could in any way diminish the width of the excavation to less than that necessary for proper construction, or could otherwise injure or delay the work, or endanger adjacent structures.

B. Whenever possible, sheeting shall be driven ahead of the excavation to avoid loss of material from behind the sheeting. If it is necessary to excavate below the sheeting, care shall be taken to avoid trimming behind the face along which the sheeting will be driven. Care shall be taken to prevent voids outside of the sheeting, but, if voids occur, they shall be filled immediately with sand and compacted.

C. Leave in place to be embedded in the backfill, or concrete, all sheeting, bracing, etc., which is indicated on the drawings to be left in place. Leave in place any and all other sheeting, bracing, etc., which the Engineer may direct to leave in place, at any time during the progress of the work, for the purpose of preventing injury to structures or property.

D. The Engineer may direct that sheeting and bracing to be left in place be cut off at any specified elevation.

E. All sheeting and bracing not to be left in place shall be carefully removed in such manner as not to endanger the construction or other structures. All voids left or caused by the withdrawal of sheeting shall be backfilled immediately using suitable materials and compaction methods.

3.06 DEWATERING

A. Refer to Specification 02140 – Dewatering.

3.07 EXCAVATION

A. Execute operation of dewatering, sheeting and bracing without undermining or disturbing foundations of existing structures or of work previously completed under this contract.

B. Excavate to widths that provide suitable room for:

1. Building structures or laying and jointing piping.
2. Placing all sheeting, bracing, and supports.

3. Cofferdamming, pumping and draining.

C. Render bottom of excavations firm, dry and acceptable in all respects.

D. Do not plow, scrap or dig by machinery, earth at finished subgrade which results in disturbance of material below subgrade, unless indicated or specified, and remove with pick and shovel, last of material to be excavated, just before placing pipe, masonry or other structure.

E. Make all excavations in open, except as otherwise specified or permitted.

F. Excavation Near Existing Facilities

1. As the excavation approaches pipes, conduits, or other underground structures, digging by machinery shall be discontinued and the excavation shall be done by means of hand tools. Such manual excavation when incidental to normal excavation shall be included in the work to be done under items involving normal excavation.

G. Unauthorized Excavation

1. If the bottom of any excavation is taken out beyond the limits indicated or prescribed, the resulting void shall be backfilled at the Contractor's expense with thoroughly compacted, screened gravel, if the excavation was for a pipeline, or with Class B concrete, if the excavation was for a masonry structure.

H. Unsuitable Material

1. If material unsuitable for foundation (in the opinion of the Engineer) is found at or below the grade to which excavation would normally be carried in accordance with the drawings and/or specifications, the Contractor shall remove such material to the required width and depth and replace it with thoroughly compacted, screened gravel, bank-run gravel, fine aggregate or concrete as directed.

3.08 TRENCHING

A. Trench Excavation

1. Where pipe is to be laid in gravel bedding or concrete cradle, the trench may be excavated by machinery to, or to just below, the designated subgrade, provided that the material remaining at the bottom of the trench is no more than slightly disturbed, as approved by the Engineer.

2. Where pipe is to be laid directly on the trench bottom, the lower part of trenches in earth shall not be excavated to subgrade by machinery, but, just before the pipe is to be placed, the last of the material to be excavated shall be removed by means of hand tools to form a flat or shaped bottom, true to grade, so that the pipe will have a uniform and continuous bearing and support on firm and undisturbed

material between joints except for limited areas where the use of pipe slings may have disturbed the bottom.

B. Depth Of Trench

1. Excavate trench to depths permitting the pipe to be laid at the elevations, slopes, or depths of cover indicated on the drawings, and at uniform slopes between indicated elevations.

C. Width Of Trench

1. Excavate trench as narrow as practicable and do not widen by scraping or loosening materials from the sides. Every effort shall be made to keep the sides of the trenches firm and undisturbed until backfilling has been completed and consolidated.
2. Excavate trenches with approximately vertical sides between the elevation of the center of the pipe and an elevation 1 ft. above the top of the pipe.

D. Trench Excavation In Fill

1. If pipe is to be laid in embankments or other recently filled material, the material shall first be placed to the top of the fill or to a height of at least 1 ft. above the top of the pipe, whichever is the lesser. Particular care shall be taken to ensure maximum consolidation of material under the pipe location. The pipe trench shall then be excavated as though in undisturbed material.

E. Length of trench open at any one time will be controlled by conditions, subject to any limits that may be prescribed by Engineer.

3.09 BACKFILLING

A. General

1. Frozen material shall not be placed in the backfill nor shall backfill be placed upon frozen material. Previously frozen material shall be removed or shall be otherwise treated as required, before new backfill is placed.

B. Fill And Backfill Under Structures

1. The fill and backfill materials shall be placed in layers not exceeding 6 in. in thickness. Unless otherwise indicated or specified, each layer shall be compacted to 95 percent in accordance with ASTM D1557.

C. Backfilling Around Structures

1. Do 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 done, special leakage tests, if required, shall be made. Promptly after the completion of such tests, the backfilling shall be started and then shall proceed until its completion. The best of the excavated materials shall be used in backfilling within 2 ft. of the structure. Unequal soil pressures shall be avoided by depositing the material evenly around the structure.

2. The material shall be placed and compacted to 90 percent in accordance with ASTM D1557 unless otherwise indicated or specified.

D. Backfilling Pipe Trenches

1. As soon as practicable after the pipes have been laid and the joints have acquired a suitable degree of hardness, if applicable, or the structures have been built and are structurally adequate to support the loads, including construction loads to which they will be subjected, the backfilling shall be started and thereafter it shall proceed until its completion.

2. With the exception mentioned below in this paragraph, trenches shall not be backfilled at pipe joints until after that section of the pipeline has successfully passed any specified tests required. Should the Contractor wish to minimize the maintenance of lights and barricades and the obstruction of traffic, he may, at his own risk backfill the entire trench, omitting or including backfill at joints as soon as practicable after the joints have acquired a suitable degree of hardness, if applicable, and the related structures have acquired a suitable degree of strength. He shall, however, be responsible for removing and later replacing such backfill, at his own expense, should he be ordered to do so in order to locate and repair or replace leaking or defective joints or pipe.

3. No stone or rock fragment larger than 12 in. in greatest dimension shall be placed in the backfill nor shall large masses of backfill material be dropped into the trench in such a manner as to endanger the pipeline. If necessary, a timber grillage shall be used to break the fall of material dropped from a height of more than 5 ft. Pieces of bituminous pavement shall be excluded from the backfill unless their use is expressly permitted, in which case they shall be broken up as directed.

4. Zone Around Pipe

   a. Backfilled with the materials and to the limits indicated on the drawings.
   b. Material shall be compacted to 90 percent by tamping.

5. Remainder of Trench

   a. Compact by tamping, in accordance with the nature of the material to 95 percent in accordance with ASTM D1557. Tamping with the excavator will not be permitted.

6. Excavated material which is acceptable to the Engineer for surfacing or pavement subbase shall be placed at the top of the backfill to such depths as may be

specified elsewhere or as directed. The surface shall be brought to the required grade and stones raked out and removed.

E. Placing And Compacting Embankment Material

1. After the subgrade has been prepared as hereinbefore specified, the material shall be placed thereon and built up in successive layers until it has reached the required elevation.

2. Layers shall not exceed 12 in. in thickness before compaction. In embankments at structures, the layers shall have a slight downward slope away from the structure; in other embankments the layers shall have a slight downward slope away from the center. In general, the finer and less pervious materials shall be placed against the structures or in the center, and the coarser and more pervious materials, upon the outer parts of embankments.

3. Each layer of material shall be compacted by the use of approved rollers or other approved means so as to secure a dense, stable, and thoroughly compacted mass. At such points as cannot be reached by mobile mechanical equipment, the materials shall be thoroughly compacted by the use of suitable power-driven tampers.

4. Previously placed or new materials shall be moistened by sprinkling, if required, to ensure proper bond and compaction. No compacting shall be done when the material is too wet, from either rain or too great an application of water, to compact it properly; at such times the work shall be suspended until the previously placed and new materials have dried out sufficiently to permit proper compaction, or such other precautions shall be taken as may be necessary to obtain proper compaction.

5. The portion of embankments constructed below proposed structures shall be compacted to 95 percent in accordance with ASTM D1557. The top 2 ft. of an embankment below a pavement base shall be compacted to 95 percent. All other embankments shall be compacted to 90 percent in accordance with ASTM D1557.

3.10 METHODS OF COMPACTION

A. Tamping and Rolling

1. Deposit backfill material and spread in uniform, parallel layers not exceeding 8 in. thick before compaction. Before the next layer is placed, each layer shall be tamped to obtain a thoroughly compacted mass. Care shall be taken that the material close to the bank, as well as in all other portions of the trench, is thoroughly compacted. When the trench width and the depth to which backfill has been placed are sufficient to make it feasible, and it can be done effectively and without damage to the pipe, backfill may, on approval, be compacted by the use of suitable rollers, tractors, or similar power equipment instead of by tamping. For compaction by tamping (or rolling), the rate at which backfilling material is

deposited in the trench shall not exceed that permitted by the facilities for its spreading, leveling, and compacting.

2. If necessary to ensure proper compaction by tamping (or rolling), the backfill material shall first be wet by sprinkling. However, no compaction by tamping (or rolling) shall be done when the material is too wet either from rain or too great an application of water to be compacted properly; at such times the work shall be suspended until the previously placed and new materials have dried out sufficiently to permit proper compacting, or such other precautions shall be taken as may be necessary to obtain proper compaction.

B. Miscellaneous Requirements

1. Whatever method of compacting backfill is used, care shall be taken that stones and lumps shall not become nested and that all voids between stones shall be completely filled with fine material. Only suitable quantities of stones and rock fragments shall be used in the backfill; the Contractor shall, as part of the work done under the items involving earth excavation and rock excavation as appropriate, furnish and place all other necessary backfill material.

2. All voids left by the removal of sheeting shall be completely backfilled with suitable materials, and thoroughly compacted.

3.11 DISPOSAL OF SURPLUS EXCAVATED MATERIALS

A. No excavated materials shall be removed from the site of the work or disposed of by the Contractor except as directed or permitted by the Engineer.

B. Surplus excavated materials suitable for backfill shall be used to backfill normal excavations in rock or to replace other materials unacceptable for use as backfill; shall be neatly deposited and graded so as to make or widen fills, flatten side slopes, or fill depressions; or shall be neatly deposited for other purposes within a haul of 1 mile from the point of excavation; all as directed or permitted and without additional compensation.

C. Surplus excavated materials not needed as specified above shall be hauled away and dumped by the Contractor, at his expense, at appropriate locations, and in accordance with arrangements made by him. See Specification Section 02080 for soil management requirements. Approval from the Owner and Engineer must be obtained prior to hauling excavated materials offsite.

3.12 DISPOSAL OF SPECIAL WASTES

A. The Contractor's attention is directed to the requirements set forth by the State of Massachusetts, Department of Environmental Protection, (MA DEP) regarding "Special Wastes" and the proper disposal thereof. All waste materials and debris, as designated by the Owner and/or Engineer, including but not limited to any sewers, storm drains, catchbasins, and combined system pipelines and associated structures,

or any portions thereof, including but not limited to sludge, grit, sediment, dirt, sand, rock, grease, roots and other liquid, solid or semi-solid materials contained therein, shall be considered "Special Wastes." In addition, any excavated soils contaminated in any manner, as designated by the Owner and/or Engineer, shall also fall under this category and shall be handled the same. When so encountered, all such materials and debris shall be removed to the extent so ordered by the Engineer and properly disposed of in strict compliance with the requirements of the MA DEP and other regulating authorities to an approved and certified waste disposal site. It shall remain the sole responsibility of the Contractor to apply for and obtain all required permits, bonds and/or insurance relative to such disposal. The Contractor shall also pay all costs associated with the disposal, required permits, bonds and insurance with no additional expense to the Owner. All handling of such "Special Waste" shall be done in strict compliance with the MA DEP requirements and/or any other federal, state or local agency having jurisdiction or authority over the same. Under no circumstances shall sewage, solids or other "Special Wastes" removed from the sewer lines be dumped or spilled onto the streets or into ditches, catch basins or storm drains. The Contractor must use watertight and State approved vehicles in transporting any wastes as hereinbefore designated.

B. The Contractor shall indemnify and save harmless the Owner and Engineer and all persons acting for or on behalf of the Owner and Engineer from all claims and liability of any nature or kind, and all damages, costs and expenses, including attorney's fees and penalties, arising from the improper handling, transportation or disposal of "Special Wastes" as determined by the MA DEP and/or any other federal, state or local agency having jurisdiction or authority over the same.

3.13 DUST CONTROL

A. During the progress of the Work, maintain the area of activities, by sweeping and sprinkling of streets to minimize the creation and dispersion of dust. If the Engineer decides that it is necessary to use calcium chloride for more effective dust control, the Contractor shall furnish and spread the material, as directed.

3.14 BRIDGING TRENCHES

A. Provide suitable and safe bridges and other crossings where required for the accommodation of travel, and to provide access to private property during construction. Remove once bridges and crossings are no longer needed.

3.15 FIELD QUALITY CONTROL

A. Site Tests

1. In accordance with SECTION 01410
2. The Contractor shall provide third party nuclear density soil compaction testing at a minimum of four locations as directed by the Owner/Engineer.

3.16 CARE AND RESTORATION OF PROPERTY

A. Restoration of existing property or structures done as promptly as practicable and not left until the end of the construction period.

END OF SECTION

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SECTION 02215

AGGREGATE MATERIALS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes

1. Requirements for furnishing and placing materials, which include Crushed Stone, Gravel Borrow and Select Borrow.
2. Location of specified materials as detailed on the Drawings or as directed by the Engineer for excavation below normal depth, utility support, replacement of unsuitable material or elsewhere, as ordered.

B. Related Sections

1. Section 02200 - Earth Excavation, Backfill, Fill and Grading.
2. Section 02500 - Paving

1.02 REFERENCES

A. American Association of State Highway and Transportation Officials (AASHTO).

1. T11, Amount of Material Finer than 0.075 mm Sieve in Aggregate
2. T27, Sieve Analysis of Fine and Coarse Aggregates.

B. American Society for Testing and Materials (ASTM).

1. D1557, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3 (2,700 kN-m/m^3)).

C. This specification includes by reference, requirements of additional specifications as listed. The Contractor shall perform the Work in accordance with requirements of the referenced specification in addition to the requirements of this Section.

1. Materials and construction methods shall conform, insofar as applicable, to the requirements of the **Standard Specifications for Highways and Bridges of the Massachusetts Highway Department of the Commonwealth of Massachusetts, dated 1988,** herein after referred to as the MHD Standard Specification, together with all errata addenda additional revisions, and supplemental specifications.

1.03 DEFINITIONS

A. The term Screened Gravel as used in these Contract Documents shall mean Crushed Stone.

1.04 SUBMITTALS

A. Shop Drawings

1. Provide sieve analysis when gradation requirements are given in the Specification.

B. Samples

1. Furnish representative sample including location of source with Shop Drawing transmittal sheet.

1.05 QUALITY ASSURANCE

A. Field Samples

1. All materials furnished by the Contractor to be incorporated into the Work shall be subject to the inspection of the Engineer. The Engineer shall be the sole judge as to the acceptability of proposed materials and said judgement shall be final, conclusive, and binding.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Storage and Protection

1. In accordance with Section E – General Conditions.

PART 2 PRODUCTS

2.01 MATERIALS

A. Crushed Stone

1. For bedding and pipe zone material for pipe larger than 3 inches diameter. Well graded in size from 3/8 inches to 3/4 inches or such other sizes as may be approved.
2. For bedding and pipe zone material for plastic pipe 3 inches diameter and less, maximum particle size shall be 3/8 inches.
3. Clean, hard, and durable particles or fragments, free from dirt, vegetation, or other objectionable matter, and free from an excess of soft, thin elongated, laminated or disintegrated pieces.

4. Screened Stone of similar size and grading to this specification may be used instead of Crushed Stone.

B. Gravel Borrow

1. Granular material well graded from fine to coarse with a maximum size, obtained from approved natural deposits and unprocessed except for the removal of unacceptable material and stones larger than the maximum size permitted.
2. Gravel shall not contain vegetation, masses of roots, or individual roots more than 18 inches long or more than 1/2 inches in diameter.
3. Gravel shall be substantially free from loam and other organic matter, clay and other fine or harmful substances.
4. Gradation requirements for gravel shall be in accordance with MHD Standard Specification Section M1.03.0, Type as detailed on the Drawings.

C. Select Borrow

1. Use inorganic natural soils and/or rock having not more than 5 percent by weight passing the No. 200 sieve and having a maximum 3 inch stone size.
2. Use only material well-graded throughout entire site range, free from roots, leaves and other organic materials, free of ice or frost and aggregations of frozen soil particles. .
3. Control the moisture content of borrow within plus or minus 3 percent optimum moisture content at the borrow source.

D. Gravel Base Course

1. In accordance with SECTION 02500.

2.02 SOURCE QUALITY CONTROL

A. Test, Inspection

1. Engineer may elect to sample material supplied at the source.
2. Assist the Engineer and/or personnel from the designated testing laboratory in obtaining samples.

PART 3 EXECUTION

3.01 INSTALLATION

A. Crushed Stone

1. Spread in layers of uniform thickness not greater than 6 inches.

2. Compact thoroughly by means of a suitable vibrator or mechanical tamper.

B. Gravel Borrow

1. Spread in layers of uniform thickness not exceeding 12 inches before compaction and moistened or allowed to dry as directed.
2. Compact thoroughly by means of suitable power-driven tampers or other power-driven equipment.
3. Compaction shall conform to 95% of minimum dry density per ASTM D 1557.
4. The percolation rate for the compacted bank-run gravel shall not exceed 5 minutes per inch.

C. Select Borrow

1. Spread in layers of uniform thickness not exceeding 12 in. before compaction and moistened or allowed to dry.
2. Compact thoroughly by means of suitable power-driven tampers or other power-driven equipment unless otherwise directed by the Engineer.

3.02 FIELD QUALITY CONTROL

A. Site Tests

1. In accordance with SECTION 01410.

END OF SECTION

SECTION 02272

GEOTEXTILE MATERIALS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes

1. Requirements for installation of geotextile filter fabric in trenches and under riprap.

B. Related Sections

1. Section 02100 - Site Preparation
2. Section 02200 – Earthwork
3. Section 02215 – Aggregate Materials

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM)

1. D3786, Test Method for Hydraulic Bursting Strength of Knitted Goods and Nonwoven Fabrics: Diaphragm Bursting Strength Tester Method
2. D4355, Test Method for Deterioration of Geotextiles From Exposure to Ultraviolet Light and Water (Xenon-Arc Type Apparatus)
3. D4491, Test Method for Water Permeability of Geotextiles by Permittivity
4. D4533, Test Method for Trapezoid Tearing Strength of Geotextiles
5. D4632, Test Method for Grab Breaking Load and Elongation of Geotextiles
6. D4751, Test Method for Determining Apparent Opening Size of a Geotextile
7. D4833, Test Method for Index Puncture Resistance of Geotextiles, Geomembranes and Related Products
8. D5261, Measuring Mass Per Unit Area of Geotextiles.

1.03 QUALITY ASSURANCE

A. General

1. Producer of fabric to maintain competent laboratory at point of manufacture to insure quality control in accordance with ASTM testing procedures.
2. Laboratory to maintain records of quality control results.

1.04 SUBMITTALS

A. Shop Drawings

1. Submit in accordance with SECTION 01300
2. Include manufacturer's recommended method of joining of adjacent fabric panels.

B. Certificate of Conformance

1. Upon each shipment/delivery of product to the work site, furnish mill certificate(s) from the company manufacturing the fabric attesting that the fabric meets the chemical, physical, manufacturing and performance requirements specified. Fabric will be rejected if it is found to have defects, rips, flaws, deterioration or other damage.

1.05 DELIVERY, STORAGE AND HANDLING

A. Provide fabric in rolls wrapped with a heavy-duty protective covering to protect fabric from, mud, dirt, dust, debris and other deleterious sources until it is installed. Label each roll of fabric with number or symbol to identify production run.

B. Do not expose fabric to ultraviolet radiation (sunlight) for more than 20 days total in period of time following manufacture until fabric is installed and covered.

C. If Engineer determines material is damaged in any way or has excessive sunlight exposure, the Contractor shall immediately make all repairs and replacements as directed by the Engineer, at no additional cost to the Owner.

1.06 SCHEDULING

A. Schedule Work so that the covering of the fabric with a layer of the cover material is accomplished immediately after inspection and approval of the placed fabric by the Engineer. Failure to comply with this requirement shall require replacement of the fabric.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURER/MATERIAL

A. The geotextile fabric shall be nonwoven polypropylene designated as MIRAFI 140N as manufactured by Nicolon/Mirafi Group, Norcross, Georgia; or acceptable equivalent and shall meet the following minimum requirements:

Property (Unit)	Unit	Test Method	Minimum Requirements
Weight	oz/sy	ASTM D5261	4.3
Grab Tensile Strength	lbs	ASTM D4632	120
Grab Tensile Elongation	%	ASTM D4632	50
Mullen Burst Strength	psi	ASTM D3786	240
Puncture Resistance	lbs	ASTM D4833	70
Trapezoid Tear Strength	lbs	ASTM D4533	50
Equivalent Opening Size (EOS)	US Std. Sieve (mm)	ASTM D4751	70 (0.21)
Permittivity	sec^{-1}	ASTM D4491	1.5
Permeability	cm/sec	ASTM D4491	0.22
Flow Rate	gal/min/sf	ASTM D4491	120
Ultraviolet Resistance (strength retained at 500 hrs)	%	ASTM D4355	70

B. To keep the number of overlay joints to a minimum, fabric shall be provided in sections not less than fifteen (15) feet in width unless otherwise approved by the Engineer prior to delivery to the site.

PART 3 EXECUTION

3.01 SUBGRADE PREPARATION

A. For Riprap

1. Prepared areas to receive geotextile in accordance with SECTION 02100 and SECTION 02200
2. Clear subgrade of all sharp objects, large stones, roots, debris, or any other foreign materials that may contribute to puncturing, shearing, rupturing or tearing of the geotextile.
3. Grade area as smooth as possible and compact in accordance with SECTION 02200, with a vibratory roller or other method approved by the Engineer.
4. Inspect subgrade and repair all unstable areas or soft spots with the installation of gravel and recompact prior to the placement of geotextile.

3.02 FABRIC INSTALLATION

A. For Riprap

1. Place at the locations shown on the Contract Drawings.
2. Unroll directly onto the prepared slope in a continuous manner. Join adjacent sections by overlapping the fabric a minimum of 12-inches. Join end sections by

overlapping the fabric a minimum of 2-feet with field-sewn joints or as recommended by the manufacturer.

3. Place fabric on slopes creating a “shingled” effect in the direction of anticipated water flow.
4. Lay fabric smooth, maximizing surface contact with the prepared subbase, free of tension, stress, folds, wrinkles, or creases.
5. Securely anchor fabric sections at the top of the slope as recommended by the manufacturer. Use anchoring pins, nails, staples or other such means to secure fabric to the subbase surface to prevent fabric movement caused by wind uplift, and/or placement of cover material.
6. Maintain sufficient amount of cover material (minimum depth of 6-inches) to protect fabric during placement of riprap. Dozer buckets or blades, or other heavy or damaging equipment shall not be in direct contact with the fabric.
7. Minimize the height from which cover material is dumped and/or dropped directly onto the fabric material in order to avoid fabric damage or movement. Equipment used for spreading and compacting the cover material shall be of the type and size to avoid damage or movement to the underlying geotextile fabric.
8. Spread cover material in the direction of fabric overlap and in a manner that avoids creating undue tension, stress, sagging, buckling and/or other movement of the underlying fabric.

B. Fabric Installation in Trenches

1. In accordance with manufacturers recommendations
2. Place fabric in trench prior to placing crushed stone pipe bedding.
3. Overlap fabric 18-inches minimum for unsewn lap joints.
4. Do not permit equipment to travel directly on fabric.
5. Place fabric in smooth condition to prevent tearing or puncture.
6. Lay fabric loosely, without wrinkles or creases.
7. Leave slack in fabric to allow for adjustment.

3.03 PROTECTION

A. Protect the work before, during and after installation, and protect the installed work covered by other Sections.

3.04 REPAIR

A. Geotextile fabric damaged during installation shall be repaired by a piece of geotextile material cut, placed and adequately anchored over the damaged area, subject to a 3-foot minimum overlap requirement or as directed by the Engineer.

B. If detrimental movement of the geotextile fabric occurs during any step of the installation, as determined solely by the Engineer, the Contractor shall remove the cover material and/or sections of fabric to the limits deemed necessary and reinstall the fabric.

C. Any fabric damage during its installation or during placement of cover materials shall be replaced by the Contractor at no additional cost to the Owner.

END OF SECTION

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SECTION 02500

PAVEMENT

GENERAL

1.01 SUMMARY

A. Section Includes

1. Requirements for construction of all temporary and permanent pavement on paved areas affected or damaged by his operations, whether inside or outside the normal trench limits, as indicated on the drawings and as herein specified.

B. Related Sections

1. Section 02200 - Earth Excavation, Backfill, Fill and Grading

1.02 REFERENCES

A. This specification makes reference to the requirements of additional specifications as listed. The Contractor shall obtain and familiarize himself with all requirements referenced by this specification prior to preparation and installation of any pavements.

1. Standard Specifications for Highways and Bridges of the Highway Department of the Commonwealth of Massachusetts, dated 1988, together with all errata addenda additional revisions, and supplemental specifications, all of which are hereinafter referred to as the MHD Standard Specifications.

1.03 PAVEMENT SCHEDULE

A. The Contractors attention is directed to the various pavements required under this contract, and their locations as detailed below.

B. All pavement thickness specified in this specification shall be of the thickness required after compaction.

1.	Location:	Site Driveway
	Type:	Flexible
	Requirements:	Min. 12" Gravel Base Course
		Thickness as indicated in Details

PRODUCTS

2.01 MATERIALS

A. Asphalt Tack

1. Tack coat shall consist of emulsified asphalt, grade RS-1 or cutback asphalt, Conforming to the requirements of the MHD Standard Specification Section M3.11.06.

B. Bituminous Base

2. Bituminous Base shall conform to the requirements of the MHD Standard Specification Section 420 and M3.11.00 for Base Course.

C. Bituminous Binder Trench Width (Permanent Pavement)

1. Bituminous Binder Course shall conform to the requirements of the MHD Standard Specification Section 420 and M3.11.00 for Binder Course.

D. Bituminous Surface, Trench Width (Permanent Pavement)

1. Bituminous Surface Course shall conform to the requirements of the MHD Standard Specification Section 460 and M3.11.00 for surface course Class I-1.

E. Bituminous Surface, Curb to Curb

1. Bituminous Surface Course shall conform to the requirements of the MHD Standard Specification Section 460 and M3.11.00 for surface course Class I-1.

F. Reinforced Concrete Base (Not Used)

1. Concrete Base shall conform to the requirements of the MHD Standard Specification, Section 430.

G. Bituminous Binder (Temporary Pavement)

1. Temporary Pavement shall be Binder Course conforming to the requirements of the MHD Standard Specification Section 420 and M3.11.00 for Binder Course.

H. Dense-Graded Crushed Stone Base Course (Temporary and Permanent) (Not Used)

1. The dense graded crushed stone base course shall consist of coarse aggregates of crushed stone or gravel and fine aggregates of natural sand or stone screenings. Uniformly pre-mixed with a predetermined quantity of water and placed on the sub-base in close conformity with the lines and grades shown on the contract plans or established by the Engineer.

2. Coarse aggregate shall consist of hard, durable particles of fragments of stone. Materials that break up when alternately frozen and thawed or wetted and dried shall not be used.
3. Coarse aggregate shall have a percentage of wear, by the Los Angeles Abrasion Test (AASTO-T-96) of not more than 45.
4. Fine aggregate shall consist of natural or processed sand.
5. The composite material shall be free from clay, loam or other cohesive soil, and shall conform to the following grading requirements:

Sieve Designation Mesh Sieves	Percentage by Weight Passing Square
2 in.	100
1-1/2 in.	70-100
3/4 in.	50-85
No. 4	30-55
No. 50	8-24
No. 200	3-l0

6. Sampling and testing shall be in accordance with the following standard AASHTO methods:

Sieve Analysis	T27
Passing No. 200 Sieve	T11

7. The gravel base course shall be spread and compacted in one layer, 4 inches in compacted depth, to the same tolerances specified above for the gravel sub-base.
8. The gravel base course material shall meet the same requirements as specified in MHD Specification M2.01.7 except as noted above.

I. Gravel Base Course

1. The gravel base course shall consist of Gravel Borrow Type C, as specified in MHD Standard Specification Section M1.03.0
2. The gravel base shall be spread and compacted in layers not exceeding 8 inches in depth compacted measurement, to not less than 95 percent of the maximum dry density of the material, as determined by the Standard AASHTO Test Designation T99 compaction test Method C within 5% of optimum moisture content as determined by the Engineer. If the material retained on the #4 sieve is 50% or more of the total sample, this test shall not apply and the material shall be compacted to the satisfaction of the Engineer. The specific density of the Gravel Base shall be maintained by determining the number of passes of a roller required to produce a constant and uniform density, after conducting a series of tests either using the sand/volume or the nuclear density-testing device.

3. Any stone with a dimension greater than 2 inches shall be removed from the base before the gravel is compacted. Compaction shall continue until the surface is even and true to the proposed lines and grades within a tolerance of ½-inch above or below the required cross sectional elevations and to a maximum irregularity not exceeding ½ inch under a l0 foot line longitudinally. Any specific area a gravel base which, after being rolled, does not form a satisfactory, solid, stable foundation shall be removed, replaced and recompacted by the Contractor without additional compensation.

2.02 SOURCE QUALITY CONTROL

A. The paving plant used by the Contractor for preparation of bituminous paving materials shall be acceptable to the Engineer who shall have the right to inspect the plant and the making of the material as specified in MHD Specification M2.01.7 except as noted above.

EXECUTION

3.01 PREPARATION

A. Prior to placing pavement, all backfill shall have been properly compacted as specified under Section 02200 to eliminate settling of backfill. No pavement shall be placed over poorly compacted backfill. Backfill and gravel base course shall be compacted, brought to the proper elevation, and dressed so that new pavement construction shall be at the required grade. The Contractor shall maintain the surfaces of all excavated and disturbed areas until the pavement is placed. If there is a time lapse of more than 24 hours between completion of preparation of subgrade or placing of gravel base course and placing of paving, or if subgrade or gravel base course has been eroded or disturbed by traffic, the subgrade or gravel base course shall be restored before placing pavement.

B. When installing permanent pavement on bituminous concrete roadway the edges of existing pavement shall be cut with a saw from the trench excavation wall or damaged area to sound undamaged material, straightened, cleaned, and painted with an accepted asphalt emulsion to ensure a satisfactory bond between it and the newly placed surface courses. Existing surface courses shall be stripped from the bituminous concrete base course for at least a 6-inch width and trimmed square and straight so that new permanent surfacing shall be placed on undisturbed bituminous concrete base course. Existing pavement shall be swept clean prior to placing any asphalt emulsion over it. Existing pavement that will be under new pavement shall be painted with asphalt emulsion to ensure a satisfactory bond.

C. Before permanent pavement is installed, the base shall be brought to the proper grade, and temporary pavement and excess gravel base shall be removed.

D. All manhole covers, catch basin grates, valve and meter boxes, curbs, walks, walls and fences shall be adequately protected and left in a clean condition. Where required, the grades of manhole covers, catch basin grates, valve boxes, and other similar items shall be adjusted to conform to the finished pavement grade.

E. The Contractor shall remove and acceptably dispose of all surplus and unsuitable material.

3.02 INSTALLATION

A. General

1. Unless indicated otherwise, all permanent bituminous pavement shall be installed in two courses or more. Bituminous base courses shall be carefully spread and raked to a uniform surface and thoroughly rolled before application of the top course.
2. All top courses of permanent paving shall be applied with acceptable mechanical spreaders in widths of at least 9 feet.
3. The rolling for all bituminous and gravel base courses shall conform to the standards listed in the appropriate Subsection of the Standard Specification.
4. Pavement shall be placed so that the entire roadway or paved area shall have a true and uniform surface, and the pavement shall conform to the proper grade and cross section with a smooth transition to existing pavement.
5. Keyways shall be cut into existing pavement where all new pavement abuts existing pavement including driveways.

B. Gravel Base Course

1. The dense graded crushed stone base course shall be placed to such depth that the furnished compacted base course is the depth as indicated on the drawings and specified herein.
2. The top of the dense graded crushed stone base course shall be below the furnish grade a distance required to accommodate the compacted pavement material as indicated on the drawings and specified herein.
3. The gravel base as herein specified shall be 12-inches thick for flexible pavement and 6-inches thick for rigid pavement.

C. Temporary Pavement:

1. Temporary pavement shall be placed over all trenches in paved areas where directed by the Engineer.
2. The Contractor, upon completing the backfilling and compaction of the trenches in the streets and the placing of the gravel base courses, shall be required to construct temporary pavement unless otherwise directed by the Engineer.

3. Temporary Pavement in Town or City roads shall be placed in one course and shall consist of 2-inch compacted thickness of hot bituminous mix, on a 12-inch compacted thickness gravel base as directed by the Engineer.
4. The Contractor shall maintain temporary pavement in good repair and flush with the existing pavement at all times until the permanent pavement is placed.
5. The temporary pavement shall not be removed until 60 days after installation or until such time that the Engineer authorizes the placement of permanent pavement at an earlier time.

D. Bituminous Base:

1. Bituminous Base shall be used in streets and parking areas as listed in Article 1.03 of this specification.
2. Bituminous Base shall be placed to the thickness as indicated in Article 1.03 of this Specification and installed in accordance with the requirements of the MHD Standard Specification and as detailed in the Contract Drawings.
3. Prior to placing bituminous base, all temporary pavement and sufficient gravel base course shall be removed, to proper depths as detailed in the contract drawings.

E. Reinforced Concrete Base: (Not Used)

1. Reinforced Concrete Base shall be used in the streets as listed in Article 1.03 of this specification.
2. Reinforced Concrete Base shall be 8-inch thick and installed in accordance with the requirements of the MHD Standard Specification.
3. Prior to placing reinforced concrete base, all temporary pavement and sufficient gravel base course shall be removed, to proper depths as detailed in the contract drawings.

F. Bituminous Binder

1. Bituminous Binder shall be used in the streets as listed in Article 1.03 of this specification.
2. Bituminous Binder shall be placed to the thickness as indicated in Article 1.03 of this Specification and installed in accordance with the requirements of the MHD Standard Specification and as detailed in the Contract Drawings.

G. Bituminous Surface

1. Bituminous Surface shall be used in the streets as listed in Article 1.03 of this specification.

2. Bituminous Surface shall be placed to the thickness as indicated in Article 1.03 of this Specification and installed in accordance with the requirements of the MHD Standard Specification and as detailed in the Contract Drawings.

H. Sidewalks, Driveways, Parking Lots and Curbing

1. Sidewalks, driveways, parking lots and curbing that are removed or damaged by the Contractor's operations shall be restored to a condition at least equal to that in which they are found immediately prior to the start of operations. Materials and methods used for such restoration shall be in conformance with the requirements of the MHD Standard Specification.
2. Where the trench location is in a sidewalk, the entire width of the sidewalk shall be replaced with new material. Side forms shall be set so as to obtain and preserve a straight edge along both sides of the walk.
3. Where trench is in a driveway, the driveway shall be repaved across its entire width with even edges.
4. Entire driveway and parking lot shall be repaved in accordance with Article 1.03 of this section.
5. Gravel base course under sidewalks and driveways shall not be less than 12" inch thick.

I. Surface Maintenance

1. During the guarantee, period, the Contractor shall maintain the bituminous surface and shall promptly make good all defects such as cracks, depressions, and holes that may occur. At all times, the surfacing shall be kept in a safe and satisfactory condition for traffic. If defects occur in surfacing constructed by the Contractor, the Contractor shall remove all bituminous concrete and base course as is necessary to properly correct the defect. After removing bituminous concrete and base course, the Contractor shall correct the cause of the defect and replace the base course and bituminous concrete in accordance with these specifications.

J. Bituminous Concrete Excavation by Cold Planer

1. The cold planer shall be at least 72 inches wide and capable of a 3-inch cut to a predetermined grade or any specified lesser depth in one pass.

2. The cold planer shall be capable of planing both bituminous pavements and cement concrete patches if the latter are found in bituminous pavements. It shall be self-propelled and have the means for planing without tearing or gouging the underlying surface. Variable lacing patterns shall be provided to permit a rough grooved or smooth surface as directed.

3. The cold planer must be equipped with an elevating device capable of loading planed material directly into dump trucks while operative and with all necessary

safety devices such as flashing lights and back-up signals so as to operate in traffic with complete safety.

4. The cold planer must comply with the standards set by the Air Quality Act for noise and air pollution.

5. Cold planers mounted on pneumatic tires will not be employed except for trimming and clean-up operations.

END OF SECTION

SECTION 02514

MWRA - DUCTILE IRON PIPE

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:

1. Furnishing and installing ductile iron pipe, fittings, jointing material, restrained joints and piping accessories.

B. Related Sections

1. Section 01010 - Summary of Work

2. Section 01090 - Reference Standards

3. Section 01040 – Quality Control

4. Section 01300 - Submittals

5. Section 02200 – Earth Excavation, Backfill, Fill and Grading

6. Section 02675 - Disinfection of Water Mains

7. Section 02704 - Pipeline Pressure and Leakage Testing

8. Section 03300 – Cast-In-Place Concrete

C. The Drawings are diagrammatic and locations of connections approximate, but pipe alignment(s) as shown on the Drawings shall be followed as closely as actual conditions will permit. The Contractor shall be responsible for field verifying dimensions. Prepare working drawings which shall be submitted to the Authority for review thirty (30) days after Notice to Proceed.

1.02 SUBMITTALS

A. Submit the following in accordance with Section 01300:

1. Product Data

a. Specifications for all ductile iron pipe, fittings, jointing material, thrust anchors, and piping accessories.

2. Shop Drawings

a. Complete layout drawings and details for ductile iron pipe.

b. Tabulated layout schedule as follows:

1) Order of installation and closures.

2) Pipe invert station and elevation at each change of grade and alignment.

3) Elements of curves and bends, both in horizontal and vertical alignment, including elements of the resultant true angular deflections in cases of combined curvature.

4) Limits of each reach of pipe thickness class and of restrained joints.

5) Limits of each reach of concrete encasement.

6) Locations of closures for length adjustment.

7) Locations of valves and other mechanical equipment.

8) Methods and locations of supports.

c. Details of fittings.

d. The Contractor shall certify that deflections of the piping from straight lines or grade shall not exceed the values stipulated in paragraph 3.01.A.2 of this section and submit this information to the Authority prior to backfilling of the Trench.

3. All physical and chemical test results along with the identification number for each mechanical joint restraint device.

1.03 QUALITY ASSURANCE

A. Manufacturer's Qualifications

1. Pipes and Fittings provided under this Section shall be the standard product in regular production by manufacturers whose products have been used in similar service for at least the last five years as verified in the product data submittal.

2. All units of the same type shall be product of one manufacturer.

B. Criteria

1. All Pipes and Fittings shall be new and in working condition and shall be designed for continuous use without exceeding the manufacturer's rated limits for stress, strain or vibration.

C. Source Quality Control

1. A hydrostatic test shall be performed on pipes and fittings at the factory

prior to shipment. The pipe and fittings shall be tested to 1.5 times the working pressure. The pipe and fittings performance and hydrostatic tests may be witnessed by the Authority.

1.04 DELIVERY, STORAGE AND HANDLING

A. Schedule

1. Contractor is advised to allow for sufficient lead time between delivery and order of ductile iron fittings.

B. Packing and Shipping

1. Ship pipe to site with wood lagging between pipes to prevent contact of pipe surfaces and coating.

2. Pack fittings, jointing materials and piping accessories to prevent damage.

3. Prevent entry of foreign matter into pipe and fittings during shipping.

4. Pack and ship coated pipe and fittings in accordance with recommendations of coating manufacturer and applicator.

C. Acceptance at Site

1. Examine pipe and related materials delivered to site. Reject all pipe, fittings, and materials not in compliance with Contract Documents, remove from the site and replace at no additional cost to the Authority.

D. Storage and Protection

1. Unload and store pipe, fittings, and accessories to prevent damage and weathering before installation.

2. Do not handle pipe and fittings by hooks inserted in ends.

3. Replace pipe and fittings in which lining has been damaged at no additional cost to the Authority.

4. Repair damaged exterior coatings before installation of pipe, fittings, specials or appurtenances at no additional cost to the Authority.

5. Store joint lubricant in closed containers and keep clean.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Pipe, fittings, and accessories

1. For restrained joint and mechanical joint pipes:

a. American Cast Iron Pipe Company, Birmingham, Alabama

b. U.S. Pipe and Foundry Company, Birmingham, Alabama

c. McWane Ductile, Phillipsburg, New Jersey

d. Or equal

2.02 MATERIALS (MWRA)

A. Pipe

1. All pipe and fittings furnished shall be accompanied by the Manufacturer's Certificate of Compliance.

2. Ductile iron conforming to AWWA C150 and AWWA C151.

3. Minimum pipe thickness class:

a. For new water main:

1) Thickness Class 52 for mechanical joint pipe.

2) Thickness Class 53 for flanged pipe.

4. Supply pipe in lengths not exceeding 20 feet.

5. Buried pipe:

a. Restrained rubber-ring type push-on or mechanical joints with mechanical restraint joint devices unless otherwise indicated.

b. Insulating flanges with wax tape coating.

6. Provide restrained joints where indicated.

7. Exposed pipe shall have flanged joints.

B. Fittings

1. Ductile iron conforming to ANSI/AWWA C110/A21.10.

2. Minimum pressure rating:

a. Mechanical joint

1) 350 psi for 24 inch and smaller

2) 250 psi for 30 inch and larger

b. Flanged joint

1) 250 psi minimum.

C. Shop coating and lining for pipe and fittings

1. Cement mortar lining for interior of water mains and fittings: ANSI/AWWA C104/A21.4. Cement mortar linings shall be double thickness. **No seal coating or interior bitumastic shall be applied to the cement mortar lining.**

2. Exterior primer for exposed pipe with diameter less than 48 inches:

a. Cook "391-N-167 Barrier Coat";

b. Carboline “Sanitile 120”;

c. Tnemec "Series N140 PotaPox";

d. PPG “Amercoat 78HB”;

e. Or equal.

3. Outside coating for buried pipe: arc-sprayed zinc per ISO 8179. The mass of zinc applied shall be 200 grams/square meter of pipe surface area. A finishing layer of asphaltic topcoat shall be applied to the zinc. Mean dry film thickness for finishing layer shall be no less than 3 mils with a local minimum not less than 2 mils. Zinc coating system shall conform to ISO 8179-1.

4. Rust-preventive compound for flange faces:

a. Houghton "Rust Veto 344";

b. Sanchem NO-OX-ID";

c. Devoe Paint "Devran 201";

d. Or equal.

D. Field coating

1. Coal tar coating for buried steel anchors: Thixotropic coal tar, MIL-C-18480; as manufactured by:

a. Kop Coat "Bitumastic No. 50";

b. Tnemec "46-64 H.B. Tnemecol";

c. Carboline “Bitumastic 50”;

d. Or equal.

E. Joints:

1. Mechanical joints: AWWA C111.

    a. Gaskets for ductile iron pipe joints shall be Ethylene-Propylene (EPDM), NSF 61 listed, compounded to resist water, oil, acids, alkalies, (aliphatic) hydrocarbon fluids and chloramines, except in contaminated areas as indicated. Gaskets for ductile iron pipe for use in contaminated areas shall be nitrile gaskets designed to resist degradation from volatile organic compounds, conforming to AWWA C111. Contaminated areas where nitrile gaskets are to be used are indicated.

    b. Natural rubber gaskets are not acceptable.

2. Flanged joints: AWWA C115

    a. Flanges: Ductile iron, flat faced

    b. Bolts: ASTM A307, chamfered or rounded ends projecting 1/4 to 1/2 inch beyond outer face of nut.

    c. Nuts: ASTM A307, hexagonal, ASME B18.2.2, heavy semi-finished pattern.

    d. Gaskets: All gaskets shall be Ethylene-Propylene (EPDM) and suitable for use with chloramines.

3. Mechanical joints with tie rods

    a. Tie rods: Galvanized ASTM A307 GR B.

    b. Washers: ASME B18.22.1, plain steel.

    c. Nuts: Galvanized A563 A heavy hex

4. Threaded connections for tapping of pipe wall: ASME B1.20.1, NPT.

    a. Threaded connections shall only be permitted where wall thickness minus foundry tolerance is equal to or greater than that required for 4-thread engagement as set forth in AWWA C151. Otherwise, provide boss or tapping saddle.

5. Mechanical Joint Restraint Device

    a. The device shall impart multiple wedging action against the pipe increasing its resistance as the pressure increases.

    b. Ductile iron heat treated to a minimum hardness of 370 BHN.

    c. Working pressure of at least 250 psi with a minimum safety factor of 2:1.

    d. Flexibility of the joint shall be maintained after burial.

e. Retainer Glands: Ductile iron conforming to ASTM A536. Dimensions which permit use with mechanical joint bell and tee head bolts conforming to AWWA C111 and AWWA C153 latest revision.

f. Twist off nuts shall be installed and result in actuating of the restraining device.

F. Mechanical Couplings/Transition Couplings

1. Insulating Type.

2. Gaskets: Ethylene-Propylene (EPDM) and suitable for use with chloramines.

3. Conform to AWWA C219.

4. Minimum pressure rating: 250 psi.

5. Coating: Flexi-Coat Fusion Bonded Epoxy

6. Sleeves shall be ductile iron solid sleeves with mechanical joints.

G. Flanged coupling adapters

1. Joins plain-end pipe to flanged valves and fittings.

2. Body: Carbon steel per ASTM A53, ASTM A512 or carbon steel having a minimum yield of 30,000 PSI.

3. Follower Flange: Ductile iron meeting or exceeding ASTM A536 for sizes 3" – 12" and Heavy rolled carbon steel per AISI 1018 for sizes 14" and above.

4. Mating plate flanges: ANSI 150 lb. flat face for sizes 3" – 5" sizes and 150 lb. drilling, per AWWA C207 Class D, ANSI for sizes 6" and above.

5. Gaskets: Ethylene-Propylene (EPDM), NSF 61 listed, compounded to resist water, oil, acids, alkalies, (aliphatic) hydrocarbon fluids and chloramines. Temperature: -40°F to 300°F.

6. Bolts and Nuts: High strength low alloy steel in accordance with AWWA C111 standards.

7. Conform to AWWA C219

8. Minimum working pressure rating 150 psi and minimum test pressure rating 225 psi.

9. Coating: Flexi-Coat Fusion Bonded Epoxy.

10. Smith-Blair "Type 914", PowerSeal 3528", Baker "Series 600", or equal.

H. Insulated Couplings

1. Materials for insulated couplings shall conform to AWWA C219

2. Bolts shall be in accordance with ASTM F593.

3. Nuts shall be in accordance with ASTM F594.

4. Steel sleeve and followers shall be epoxy coated inside and outside as specified in AWWA C213.

I. Insulation: Urethane Foam type, conforming with ASTM C591.

J. Friction Clamps:

1. Galvanized carbon steel meeting ASTM A36 and ASTM A123.

2. Bolts and Nuts shall be Galvanized A325 High Strength

3. Size: As shown on Drawings.

K. Water Services

1. Water services will be at least 1 inch, Type K copper, in accordance with AWWA C800-6.

2. Couplings, if required, for existing to new service pipe connections shall have compression connection on the inlet.

3. Fittings, if required, shall be certified to be NSF 61 compliant with the "Safe Drinking Water Act" requirements for low lead in potable and non-potable water applications.

L. Mechanical Joint (MJ) Restraint Adaptor

1. MJ Restraint Adaptor shall be provided in sizes shown on the Drawings.

a. Shall meet the ductile iron and working pressure specifications of AWWA compact fittings, ANSI/AWWA C153/A21.53 and C110/A21.10 - American National Standard for Ductile Iron Compact Fittings, 3-Inch Through 36-Inch for Water.

b. Epoxy coated ductile iron conforming to ASTM A536, 65-45-12 and pressure rating of 350 psi.

c. Furnish with Stainless Steel Accessories.

d. Shall connect the valves and/or fittings at a linear distance not exceeding three (3) inches.

e. Nuts for 3 through 12-inch sizes shall be SAE Grade 5 steel with black oxide coating. Nuts for 14-inch and larger adaptors shall be heavy hex Corten steel conforming to ASTM A242.

f. Shall be supplied with an NSF 61 asphaltic seal coating in accordance with ANSI/AWWA C104/A21.4.

g. NSF 61, 7-mil fusion bonded epoxy conforming to AWWA C116/A21.16-09 and the coating, surface preparation and application requirements of ANSI/AWWA C550.

h. Long-bolt Paks, to restrain C110 full-bodied fittings, certain valves, etc. with thicker bolt flanges

2.03 MATERIALS

A. Not Used.

2.04 FABRICATION

A. Flange by mechanical joint pieces

1. Mark top for horizontal pieces and side for vertical pieces at foundry.

B. Flanged joint pipe

1. Extend pipe completely through screwed-on flanges.

2. Machine finish the pipe end and flange face in a single operation.

3. Fabricate flange faces flat and perpendicular to the pipe center line.

C. Mechanical Joint Restraint Device

1. An identification number consisting of year and day, plant designation and shift number, shall be cast into each gland body.

a. All physical and chemical test results shall be recorded with the identification number on the casting.

b. Production pieces that are too small to accommodate individual numbering, such as fasteners and wedges, shall be controlled in segregated inventory until such time as all quality control tests are passed. These component parts may then be released to a general inventory for final assembly and packaging.

2. The coating system shall consist of two coats of liquid fluoropolymer coating with heat curing to follow each coating.

a. All T-bolts, wedge assemblies and related parts shall be processed through a phosphate wash, rinse and drying operation prior to coating application.

b. All casting bodies shall be surface pretreated with a phosphate wash, rinse and sealer before drying.

c. The coating shall be electrostatically applied and heat cured. The coating shall be a polyester based powder and provide corrosion, impact and UV resistance.

D. Flanged coupling adapters and mechanical couplings

1. Prepare inner and exterior surfaces of couplings for painting in accordance with the recommendations of paint manufacturer.

2. Paint with liquid epoxy in accordance with AWWA C210.

3. Clean and shop prime other surfaces with the standard rust-inhibitive primer of the manufacturer.

4. Do not paint flange mating surfaces on flanged coupling adapters.

5. Flanged coupling adapters shall have anchor studs.

E. Insulated Couplings

1. Prepare and cover each direct buried, insulated coupling with AWWA C217 cold applied tape as indicated.

F. Outlets

1. Furnish factory welded-on boss under following conditions:

a. Branch outlet is 12 inch or smaller.

b. Diameter of pipe is at least twice diameter of branch.

c. Working pressure 250 psi.

G. Reducers

1. Furnish concentric pattern reducers.

H. Gaskets

1. Gasket for potable water service shall be certified as suitable for chlorinated potable water (NSF 61), compatible with joint specified herein and the specified field test pressure service conditions and provided by pipe manufacturer.

2. Material shall comply with the requirements of NSF/ANSI Standard 61 and the “No Lead” requirements of NSF/ANSI Standard 372.

I. Field coating

1. Coal tar coating for buried steel anchors: Thixotropic coal tar, MIL-C-18480; as manufactured by: Kop-Coat "Bitumastic No. 50", Tnemec "46-65 Heavy Tnemecol", Carboline “Bitumastic 50”, or equal.

2. V-Bio Enhanced Polyethylene Encasement wrap for buried ductile iron water main: ANSI/AWWA C105/A21.5, seamless.

a. V-Bio wrap shall consists of three (3) layers of co-extruded linear low density polyethylene (LLDPE), fused into a single thickness of not less than eight mils. Inner layer in contact with the pipe exterior surface shall be infused with a blend of an anti-microbial additive and a volatile corrosion inhibitor.

b. V-Bio wrap shall have markings of "Warning – Corrosion Protection – Repair Any Damage."

c. Remove lumps of clay, mud and cinders from outside surface of pipe prior to installation.

d. V-Bio wrap manufactured by: McWane Ductile, US Pipe, American Pipe, or equal.

J. Field welding of ductile iron pipe is not permitted.

PART 3 EXECUTION

3.01 INSTALLATION

A. Alignment

1. Lay piping to lines and grades indicated. Transfer all lines and grades from basic survey control points.

2. Deflections from straight line or grade shall not exceed values stipulated in Table 4 or Table 5 of AWWA C600 and the manufacturer's values for deflections.

3. Install either shorter pipe sections or fittings to conform to alignment or grade indicated on the Drawings.

B. Laying pipe

1. Protect pipe from lateral displacement by placing granular embedment material.

2. Lay pipe with bell ends facing direction of laying.

C. Cutting pipe

1. Cut pipe without damage to pipe or lining.

2. Provide smooth, straight cuts at right angles to pipe axis.

3. Remove all roughness and sharp edges from cut end of pipe.

4. Bevel cut ends of push-on joint pipe.

5. Do not cut pipe with hydraulic squeeze type cutters, portable guillotine saw, or oxyacetylene torch.

6. Do not cut tapping holes with an oxyacetylene torch.

D. Cleaning

1. Clean all foreign material from interior of pipe and fittings before installation.

2. Wipe clean all joint contact surfaces before jointing pipe and fittings.

3. Prevent all material from entering pipe or joints during installation.

4. Seal open end of pipe with watertight plug when pipe laying is stopped.

5. Keep interior of installed pipe clean until the pipeline is placed into service.

E. Inspection

1. Examine pipe and fittings for cracks and other defects immediately before installation.

2. Examine the spigot ends of pipe.

3. Remove and replace all pipe and fittings that are cracked or otherwise not in conformance with the Contract Documents at no additional cost to the Authority.

F. Field Joints

1. Assemble field joints in accordance with the recommendations of the manufacturer.

2. Mechanical Joints:

a. If mechanical joint fails to seal, disassemble, clean, and reassemble joint at no additional cost to the Authority.

b. Tighten bolts to torque values listed in AWWA C111.

c. Do not over tighten bolts.

d. Align holes in harnessed mechanical joints with tie rods to permit installation of tie rods.

e. When installing flange and mechanical joint pieces, align holes in mechanical joint bell and flange to straddle top center line for horizontal piping and side centerline for vertical piping.

3. Flanged Joints

a. Do not restrain opposite end of pipe or fitting in any direction when

tightening flange bolts.

b. Tighten bolts gradually and at uniform rate to provide uniform compression of gasket.

c. Do not over stress flanges.

d. Allow one flange to move in any direction while tightening flange bolts.

e. Insulate flanges shown on Drawings.

4. Couplings

a. Provide space of 1/4 inch to one inch between pipe ends.

b. Clean and remove foreign material from pipe and coupling surfaces which contact gaskets during assembly.

c. Install coupling with all parts square and symmetrical with the pipe.

d. Uniformly tighten assembly bolts so coupling is free from leaks.

e. Couplings shall be installed with heat shrinkable sleeve for corrosion protection.

G. Field Repair of Protective Coatings and Linings

1. Entry into pipe for application of interior linings to unlined ends shall be from open ends or through access manholes.

2. Field Repair of Shop-Applied Coatings and Linings

a. For Flanged Joints: Extend cement mortar lining to ends of pipe.

b. For Restrained Joints

1) Cement Mortar: Line to end of pipe on spigot end. Hold back lining in bells one inch beyond the point of nominal full joint engagement. Field repair in accordance with ANSI/AWWA C104/A21.4.

c. For Coupled Joints

1) Interior Linings: Cement Mortar Lining shall extend to end of pipe.

2) Exterior Coatings: Repair damaged areas of shop coatings on pipe and coupling after installation at no additional cost to the Authority.

H. Reducers

1. All reducers shall be concentric pattern, unless indicated.

I. Concrete Encasement

1. Install concrete encasement as indicated.

2. Provide concrete and reinforcing steel as specified in Section 03300.

3. Support, block, and anchor all pipe to be encased to prevent flotation.

J. Reaction Anchorage

1. Anchor all pipe, fittings, and valves subject to internal pressure to prevent separation of joints.

2. Provide joint anchors on all push-on and mechanical joint tees, Wye branches, bends, plugs, and valves.

3. Provide restrained joints on pipes where indicated.

4. Provide mechanical joints with tie rods for joint anchorage, as indicated.

K. Pipe Insulation

1. Provide pipe insulation when depth of cover over water pipe is less than 4.5 ft.

2. Install per the manufacturer's installation recommendations.

L. Field welding of ductile iron pipe is not permitted.

** END OF SECTION **

SECTION 02516

MWRA - VALVES AND APPURTENANCES

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:

1. Furnishing and installing AWWA gate valves (6" through 16").
2. Furnishing and installing gate valves for blow offs.
3. Furnishing and installing corporation stops.
4. Furnishing and installing miscellaneous fittings and appurtenances.

B. Related Sections:

1. Section 01050 – Field Engineering
2. Section 01300 – Submittals
3. Section 02514 – MWRA - Ductile Iron Pipe
4. Section 02607 – Precast Concrete Manholes
5. Section 09900 – Painting

1.02 SUBMITTALS

A. Submit the following in accordance with Section 01300:

1. Product Data
    a. Complete specifications, data, and catalog cuts.
    b. Submittal shall include valve dimensions, coating materials, torque capability of shaft and size of nut.
    c. Submittal shall state the direction to open and the number of turns required to operate valve from fully closed to fully open position. Contractor to confirm turn counts in field prior to installation.
    d. The Contractor shall confirm turn counts in the field prior to installation of the valve and submit the number of turns to the Authority for each valve to be installed.
2. Quality Control Submittals

a. Test Reports:

1) Manufacturer certified copies of valve test results, in conformance with AWWA C509 (for sizes 6” to 16”) or AWWA C515 (for 24”) or AWWA C504 (54” and 60”) before valves are shipped.

b. Certificates:

1) An affidavit of compliance with AWWA C509, (for sizes 6” to 16”) or AWWA C515 (for 24”) or AWWA C504 (54” and 60”) from manufacturer before valves are shipped.

3. Qualifications:

a. Evidence of qualifications specified in Paragraph 1.03.A.1.

1.03 QUALITY ASSURANCE

A. Manufacturer’s Qualifications

1. Valves and appurtenances provided under this Section shall be the standard product in regular production by manufacturers whose products have been used in similar service for at least the last five years as verified in the product data submittal.

2. All units of the same type shall be product of one manufacturer.

B. Criteria

1. All valves and appurtenances shall be new and in working condition. Valves shall be designed for continuous use without exceeding the manufacturer’s rated limits for stress, strain or vibration.

C. Source Quality Control

1. A hydrostatic test shall be performed on valves at the factory prior to shipment. The valve shall be tested to two (2) times the working pressure. The valve performance and hydrostatic tests may be witnessed by the Authority.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Protect threads and seats from corrosion and damage. Rising stems and exposed stem valves shall be coated with a protective oil film which shall be maintained until time of installation.

B. Furnish covers for all openings.

1. All valves shall be shipped and stored until time of use with wood or plywood covers on each valve end.

C. Store equipment in a manner that provides access for inspection and identification. Inspect valves on delivery, and if valves do not meet Contract Documents remove from the site and replace at no additional cost to the Authority.

D. At delivery, clean all debris and foreign material out of valve openings. All nuts and bolts on each valve shall be checked for tightness, all operating mechanisms on each valve shall be operated to verify functioning, and valves shall be checked for defects in workmanship or materials.

E. Store all equipment in covered storage off the ground.

PART 2 PRODUCTS

2.01 MWRA GATE VALVES

A. General

1. Gate valves shall open by turning right, (clockwise). Cast word "open" and an arrow indicating direction to open on each valve body or operator.

2. Operating nuts shall be 1-3/4 inches square at the base and shall be loosely fitted on the stem.

3. Number plate shall include number of turns to operate valve from fully closed to fully open position.

4. All interior and exterior ferrous parts of the valves, except finished or bearing surfaces and stainless steel components, shall be shop coated with a fusion bonded epoxy coating conforming to AWWA C550. Machine surfaces shall have a protective coating of rust inhibitive compound: Houghton "Rust Veto 344", Sanchem "NO-OX-ID", Devoe Paint "Devran 201", or equal.

5. Gaskets for gate valve joints shall be resilient chloramine Ethylene-Propylene (EPDM) rubber conforming to AWWA C111.

6. Asphalt Varnish: Shop coat external surfaces of valves to be buried with 2 coats of asphalt varnish complying with Federal Specifications TT-V-51F.

B. Gate valves shall be furnished and installed in accordance with the requirements of AWWA C509, and shall meet the specified requirements which follow:

1. Gate valves for buried service shall have mechanical joints conforming to AWWA C111. Gate valves for installation inside vaults shall have flanged joints, conforming to ASME B16.1 Class 125 for flange diameter and drilling.

2. Gate valves shall be non-rising stem, manufacturer's standard pattern with "O" ring seals, inside screw, resilient seat-type with iron-body, fully bronze mounted, packed and ready for use, conforming to AWWA C509.

3. Gate valves shall be designed for vertical setting except as otherwise indicated.

4. Gate valves shall be rated for working water pressure of 250 psi.

5. The bonnet shall have a removable thrust plate to permit removal and replacement of the valve stem and "O" ring seals while they are wide open and in service.

6. Stem Seals: All valves shall be provided with stem seals of the O-ring inserted above the thrust collar.

7. Valve Gate: The gate shall have resilient chloramine EPDM rubber gasket, minimum thickness 3/8 inch, bonded to or mechanically attached to both sides of the wedge type gate, with no sliding or shear, on the resilient seat, when compressed to a drip tight shutoff.

8. Stainless Steel Bolts and Nuts: The bolts and nuts that fasten the bonnet to the valve body and bonnet thrust plate to the bonnet shall be AISI Type 316 stainless steel.

C. Sizes equal to or greater than 24-inch shall also conform to the following:

1. Gate valves, including operators, shall conform to AWWA C515.

2. Valves shall be rated 250 working pressure, ductile iron body.

3. Valves shall be specifically designed for horizontal installation and equipped with beveled gearing.

4. Wedge type gate shall be ductile iron, encapsulated with resilient chloramine resistant EPDM rubber.

5. Horizontal resilient seated valves shall be equipped with rollers and scrapers and bypass as indicated.

6. Flanged Joints: Conform to AWWA C115.

7. Valve shall have bonded rubber on both sides of gate.

D. Fabricate valves in accordance with the following schedule:

Size (inch)	Service	Max. Pressure Differential Across Valve (psi)	Ends	Type of Stem	Operator	Minimum Turn Count
6	Water	250	MJ x MJ	NRS	WN	20
8	Water	250	MJ x MJ	NRS	WN	26
8	Water	250	FL x FL	NRS	WN	26
12	Water	250	MJ x MJ	NRS	WN	38
12	Water	250	FL x FL	NRS	WN	38
16	Water	250	FL x FL	NRS	WN	50
24	Water	250	FL x FL	NRS	WN	228(1)

Abbreviations in gate valve schedule as follows:

FL – Flanged Ends
MJ – Mechanical Joint Ends
NRS – Non-rising Stem
WN – Wrench Nut
(1) - Turn Count includes bevel gear

E. Manufacturers

1. American Flow Control, Mueller, Kennedy, or equal.

2.02 EXTENSION STEMS

A. Extension stems shall be furnished and installed on all valves installed in manholes, or as otherwise indicated. Extension stems shall not be smaller in diameter than the valve actuator stem or shaft. Extension stems shall meet the following requirements:

1. Construct stem and wrench nut to extend within 6-inches of manhole rim or valve box cover.

2. Extension stem shall be fabricated with a 1-3/4" x 1-3/4" wrench nut.

3. Extension stems shall be solid steel.

2.03 EXTENSION GUIDES

A. Stem guides shall be cast iron, bronze bushed, and adjustable in two directions.

B. Stem guide spacing shall not exceed 100 times the stem diameter or 10 feet, whichever is smaller.

C. The extension stem shall have a collar; the collar shall be pinned to the stem and shall bear against the stem thrust guide.

D. At least two stem guides shall be furnished with each valve.

E. The top stem guide shall be designed to carry the weight of the extension stem.

2.04 MWRA VALVE BOXES AND EXTENSIONS

A. All valve boxes and covers shall be manufactured in the USA. The minimum outside diameter of the boxes shall be 5 1/2-inches and the lengths shall be as necessary to suit the ground elevation and the depth of each valve operator, regardless of the depth of cover.

B. Each valve shall be provided with a box which has a close fitting 7 1/4-inch diameter cover and is substantially dirt-tight. The top of the cover shall be flush with the top of the box rim. The word "WATER" shall be cast in the top of the cover.

C. Valve boxes shall be of cast iron and the adjustable sliding, heavy pattern type. They shall be so designed and constructed as to prevent direct transmission of traffic loads to the pipe or valve. The upper or sliding section of the box shall be provided with a flange on the top of the section (not on the bottom) having sufficient bearing area to prevent undue settlement.

The lower section of the box shall be designed to enclose the operating nut and stuffing box of the valve and to rest on the backfill. The boxes shall be adjustable through at least six inches (6-inches) vertically without reduction of lap between sections to less than eight inches (8-inches)

D. Manufacturers: Tyler Union, "6850 Series"; Bingham & Taylor, "No. 4908"; East Jordan Iron Works, "8555 Series"; or equal.

2.05 CORPORATION STOPS

A. Corporation stops shall conform to AWWA C800, 1.5-inch in diameter and shall be installed where indicated.

B. All corporation stops shall be certified to be NSF 61 compliant in accordance with the "Safe Drinking Water Act" requirements for low lead in potable (human consumption - drinking and cooking) and non-potable water applications (non-human consumption).

C. Corporation stop shall have AWWA taper threaded inlet and M.I.P. thread outlet.

D. Manufacturers

1. Mueller Company Figure H-9968N.

2. The Ford Meter Box Co., Inc. Model FB 400-6-NL.

3. AY McDonald.

4. Or equal.

2.06 SOURCE QUALITY CONTROL

A. Tests

1. Test all gate and butterfly valves in accordance with AWWA C504, C509, or C515, as applicable.

B. Inspection

1. The protective fusion-bonded epoxy coating on interior surfaces of each valve shall be holiday tested in accordance with AWWA C550 and shall be electrically void free.

PART 3 EXECUTION

3.01 INSTALLATION

A. Valves

1. Prior to installation, operate valve from fully open to fully closed and then reopen. Record the turn count. Both turn counts should be the same. Compare to design turn count. If field turn count does not match the design turn count, then the manufacturer

is required to be onsite to resolve

2. Prior to installation of valves, inspect and repair damaged valve coatings in accordance with manufacturer's recommended procedure at no additional cost to the Authority.

3. Install gate valves in accordance with recommendations set forth in AWWA C509 or C515, as applicable, and recommendations of manufacturer.

4. Gate valves in vaults/manholes shall have flanged ends. Buried gate valves shall have mechanical joint ends unless otherwise indicated.

B. Extension stems

1. Install extension stems for buried valves and for valves enclosed in vaults as indicated.

2. Install stems with extension guides as indicated.

C. Number Plates

1. Install on valve body.

D. Valve boxes shall be set plumb, flush with the ground or paved surface, and centered directly over the operating nut of the valves. Earth fill shall be carefully tamped around the valve boxes to a distance of 4-feet on all sides of the boxes or to the undisturbed trench face, if less than 4-feet.

G. GPS SURVEY

E. Prior to backfilling the pipe and fittings, collect and submit as-built global positioning survey (GPS) points performed by a Licensed Professional Land Surveyor registered in the Commonwealth of Massachusetts.

F. GPS points shall be collected at all valves.

G. GPS shall be performed per Section 01050 Field Engineering

** END OF SECTION **

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SECTION 02607

PRECAST CONCRETE MANHOLES

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes

1. Requirements for modular precast concrete manhole sections with tongue-and-groove joints, cast iron covers, accessories and appurtenances.

B. Related Sections

1. Section 03300 - Cast-In-Place Concrete

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM)

1. A48, Standard Specification for Gray Iron Castings.
2. A615 Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
3. C32, Standard Specification of Sewer and Manhole Brick (Made from Clay or Shale), AASHTO Designation M91-42, Red Sewer Brick Only Grade SS.
4. C144, Standard Specification for Aggregate for Masonry Mortar.
5. C150, Standard Specification for Portland Cement.
6. C207, Standard Specification for Hydrated Lime for Masonry Purposes.
7. C270, Standard Specification for Mortar for unit Masonry
8. C443, Standard Specification for Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets.
9. C478, Standard Specification for Precast Reinforced Concrete Manhole Sections.
10. C923, Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Laterals.
11. D4101, Standard Specification for Propylene Plastic Injection and Extrusion Materials.

1.03 SYSTEM DESCRIPTION

A. Design Requirements

1. Manholes shall conform in shape, size, dimensions, materials, and other respects to the details indicated in the Contract drawings.
2. All manholes shall have concrete bases. Invert channels shall be formed with brickwork upon the base.
3. Manhole walls (barrels and cones) shall be precast concrete sections. The corbel (not to be more than 12-in.) shall be built of brickwork to permit adjustment of the frame to meet the finished surface.
4. The inverts shall conform accurately to the size of the adjoining pipes. Side inverts shall be curved and main inverts (where direction changes) shall be laid out in smooth curves of the longest possible radius which is tangent, within the manhole, to the centerlines of adjoining pipelines.

1.04 SUBMITTALS

A. Shop Drawings

1. In accordance with Specification SECTION 01300 - SUBMITTALS.

B. Samples

1. Provide representative samples of materials if requested by the Engineer.

PART 2 PRODUCTS

2.01 PRECAST CONCRETE SECTIONS

A. Conform to the ASTM C478 with the following exceptions and additional requirements:

1. All cast in place concrete shall be Class A and shall conform to the requirements specified under SECTION 03300.
2. Wall sections to be 5-inch thick minimum.
3. Type II cement in accordance with ASTM C150.
4. 4.0 feet and 5.0 feet diameter manholes minimum of 4,000 psi - 28 days compressive strength.
5. 6.0 foot diameter manhole minimum of 5,000 psi. - 28 days compressive strength.

   Except as otherwise permitted.
6. Sections shall be cured by subjecting them to thoroughly saturated steam at a temperature between 100 and 130 degrees F. for a period of not less than 12 hours or, when necessary for such additional item as may be needed to enable the sections to meet the strength requirements.
7. No more than two lift holes may be cast or drilled in each section.

8. The date of manufacture and the name of trademark of the manufacturer shall be clearly marked on the inside of the barrel.
9. Acceptance of the sections will be on the basis of material tests and inspection of the completed product.

B. Flat Slab Tops

1. Thickness and reinforcement as indicated on the drawings and in accordance with ASTM C-478.

C. Cones

1. Cones shall be precast sections of construction similar to above.

D. Bases

1. The tops of the bases shall be suitably shaped by means of accurate bell-ring forms to receive the barrel sections.
2. All holes for pipes shall be cast in the base sections so that there is a clear distance of four inches minimum between the inside bottom of the base section and the pipe invert.
3. Base pad shall be pre-cast with extended base as indicated on drawings and herein specified.
4. Openings for pipe and materials to be embedded in the wall of the base for these joints shall be cast in the base at the required locations during the manufacture of the base.

2.02 COMPONENTS

A. Pipe Seals

1. Premolded elastomeric-sealed joints fitted or cast integrally into the pipe opening of the manhole base and/or wall section.
2. Provide a watertight joint.
3. Maximum 10-degree omni-directional deflection.
4. Conform to ASTM C-923.
5. Seals to be:
   a. Lock Joint Flexible Manhole Sleeve made by Interpace Corp., Parsippany, NJ;
   b. Kor-N-Seal made by National Pollution Control Systems, Inc., Nashua, NH;
   c. A-LOK manhole pipe seal made by A-LOK Corp., Trenton, NJ;
   d. or an acceptable equivalent product.
6. All materials, accessories and construction methods used in making the joints shall be supplied or approved by the manufacturer of the premolded elastomeric-sealed joint. Furnish manufacturer's written instructions to the Engineer.

B. Exterior Coating

1. The material shall be:

   a. Carboline Bitumastic 300M by Somay Products, Inc., Miami, FL or
   b. Sonoshield HLM 5000 by Sonoborn, Shakopee, MN or
   c. Acceptable equivalent product.

C. Rubber Gaskets (between manhole sections)

1. In accordance with ASTM C443.
2. Gasket configuration per manufacturers recommendation.

D. Butyl Resin Gaskets (between manhole sections)

1. In accordance with ASTM C990.
2. Gasket configuration per manufacturer's recommendation.

2.03 ACCESSORIES

A. Manhole Frames and Covers

1. Furnish all cast-iron manhole frames and covers conforming to the details shown on the drawings, or as hereinbefore specified.
2. Castings shall be of good quality, strong, tough, even-grained cast iron, smooth, free from scale, lumps, blisters, sandholes, and defects of every nature which would render them unfit for the service for which they are intended. Contact surfaces of covers and frame seats shall be machined to prevent rocking of covers.
3. Casting shall be thoroughly cleaned and subject to a careful hammer inspection.
4. Castings shall be at least Class 25 conforming to the ASTM A48.
5. Standard sewer manhole frames and covers to have 24 inch clear opening (26 inch diameter covers) and minimum 6 inch high frames, manufactured by East Jordan Iron Works (formerly LeBaron Foundry, Inc.), or approved equal. Pattern of cover and lettering shall comply with the Owner's standards.
6. Watertight sewer manhole frames to have 26 inch diameter covers with 6 stainless steel bolts, and watertight gasket, manufactured by East Jordan Iron Works (formerly LeBaron Foundry, Inc.) or approved equal. Pattern of cover and lettering shall comply with the Owner's standards.

B. Brick

1. Sound, hard, and uniformly burned brick, regular and uniform in shape and size, of compact texture, and satisfactory to the Engineer.
2. In accordance with ASTM C32, Red Sewer Brick Only Grade SM.

3. In accordance with AASHTO M91-42, Red Sewer Brick Only Grade SM.
4. Reject brick shall be immediately removed from the work.

C. Mortar for Brickwork

1. In accordance with ASTM C270.
2. Composed of Portland cement, hydrated lime, and sand in which the volume of sand shall not exceed three times the sum of the volume of cement and lime.
3. The proportions of cement and lime shall be 1:1/4.
4. Cement shall be Type II Portland cement in accordance with Specification SECTION 03300.
5. Hydrated lime shall be Type S conforming to the ASTM C207.
6. Hydrated lime shall be "Mortaseal" manufactured by U.S. Gypsum or
7. "4X Hydrate" manufactured by the New England Lime Company or
8. An acceptable equivalent product.
9. The sand shall conform to ASTM C144.

PART 3 EXECUTION

3.01 INSTALLATION

A. Manhole Sections

1. Set so as to be vertical and with sections in true alignment.
2. All holes in sections used for 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 (just short of "balling"), hammered into the holes until it is dense and an excess of paste appears on the surface, and then finished smooth and flush with the adjoining surfaces.

B. Butyl Resin Gaskets (between manhole sections)

1. In accordance with manufacturers recommendation.
2. Install in all joints between precast sections.

C. Brickwork

1. Only clean bricks shall be used.
2. Bricks shall be moistened by suitable means, until they are neither so dry as to absorb water from the mortar nor so wet as to be slippery when laid.

3. Each brick shall be laid in a full bed and joint of mortar without requiring subsequent grouting, flushing, or filling, and shall be thoroughly bonded.

4. All sewer inverts shall be constructed in-place after installation of sewer piping to manhole is complete. The bench shall be even with the crown of the pipe. Above ground construction of manhole inverts is not acceptable.

D. Plastering And Curing Brick Masonry

1. Outside faces of brick masonry adjustment courses shall be plastered with mortar to a thickness of 1/2-inch.

2. If required, the masonry shall be properly moistened prior to application of the mortar.

3. The plaster shall be carefully spread and troweled. After hardening, the plaster shall be carefully checked by being tapped for bond and soundness.

4. Unbonded or unsound plaster shall be removed and replaced.

5. Brick masonry and plaster shall be protected from too rapid drying by the use of burlaps kept moist, or by other suitable means, and shall be protected from the weather and frost, to insure maximum strength.

E. Exterior Coating

1. The exterior surfaces of all manholes shall be given two coats of bituminous waterproofing material totaling a minimum of 14 mils in thickness.

2. The waterproofing material shall be applied by brush or spray and in accordance with the instructions of the manufacturer.

3. Time shall be allowed between coats to permit sufficient drying so that the application of the second coat has no effect on the first coat.

3.02 SETTING MANHOLE FRAMES AND COVERS

A. Manhole frames shall be set with the tops conforming accurately to the grade of the pavement or finished ground surface or as indicated on the drawings or directed. Frames shall be set concentric with the top of the masonry and in full bed of mortar so that the space between the top of the manhole masonry and the bottom flange of the frame shall be completely filled and made watertight. A thick ring of mortar extending to the outer edge of the masonry shall be placed all around and on the top of the bottom flange. The mortar shall be smoothly finished and have a slight slope to shed water away from the frame.

B. Manhole frames and covers shall be brought to grade with 2 or more, but no more than 5 courses of brick.

C. Manhole covers shall be left in place in the frames on completion of work at the manholes.

3.03 FIELD QUALITY CONTROL

A. Testing

1. Gravity Sewer Manholes shall be vacuum tested in accordance with ASTM C1244 prior to backfilling.
2. Lift holes shall be plugged and pipes entering the manhole shall be temporarily plugged.
3. A vacuum of 10 inches of mercury shall be drawn on the manhole.
4. The manhole shall pass if the time for the vacuum reading to drop from 10 inches of mercury to 9 inches of mercury meets or exceeds the values in the Table below.
5. If the manhole fails the initial test, necessary repairs shall be made by a method approved by the Engineer. The manhole shall then be retested and repairs shall be made until a satisfactory test is obtained.

Table 1 Minimum Test Times for Various Manhole Diameters

Depth	Diameter (in.)								
Ft	30	33	36	42	48	54	60	66	72
	Time (sec)								
8	11	12	14	17	20	23	26	29	33
10	14	15	18	21	25	29	33	36	41
12	17	18	21	25	30	35	39	43	49
14	20	21	25	30	35	41	46	51	57
16	22	24	39	34	40	46	52	58	67
18	25	27	32	38	45	52	59	65	73
20	28	30	35	42	50	53	65	72	81

3.04 CLEANING

A. Manholes to be free of construction debris prior to final inspection.

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SECTION 02618

DUCTILE-IRON PIPE AND FITTINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Requirements to furnish, lay, joint, and test ductile-iron pressure pipe, fittings (including special castings), and appurtenant materials and equipment indicated on the Drawings and specified in this Section.

1.02 REFERENCES

A. American Water Works Association (AWWA)/American National Standards Institute (ANSI)
   1. C104/A21.4, Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water.
   2. C105/A21.5, Polyethylene Encasement for Ductile Iron Pipe Systems
   3. C111/A21.11, Rubber-Gasket Joints for Ductile-Iron and Pressure Pipe and Fittings.
   4. C115/A21.15, Flanged Ductile Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges.
   5. C150/A21.50, Thickness Design of Ductile-Iron Pipe.
   6. C151/A21.51, Ductile-Iron Pipe, Centrifugally Cast for Water.
   7. C153/A21.53, Ductile-Iron Compact Fittings, 3 inches through 24 inches, and 54 inches through 64 inches for Water Service
   8. C600, Installation of Ductile-Iron Water Mains and Their Appurtenances
   9. C65l, Disinfecting Water Mains

B. American Society of Testing and Materials (ASTM)
   1. A536, Standard Specification for Ductile Iron Castings

1.03 REQUIREMENTS

A. Ductile iron pipe used for water mains shall be cement lined thickness Class 52 push-on joint, size as indicated on the drawings.

B. Location of restrained joints shall be based on Thrust Restraint Design for Ductile Iron Pipe (Second Edition), published by Ductile Iron Pipe Research Association.

1.04 SUBMITTALS

A. In accordance with Article 6.17 of the General Conditions and Section 01300 – Submittals, submit the following:

B. Shop Drawings
   1. Piping layouts in full detail.
   2. Location and type of backup block or device to prevent separation.

3. Schedules of all pipe, fittings, special castings, couplings, expansion joints, restrained joints and other appurtenances.
4. Detailed disinfection plan consistent with AWWA C651, including locations of chlorination, flushing, and sampling points, identification of disinfectant, dosage calculations, and detailed plan for neutralizing chlorinated water used prior to discharge

C. Certificates
1. Sworn certificates of shop tests showing compliance with specified standard.

D. Manufacturer's Literature
1. Catalog cuts of joints, couplings, harnesses, expansion joints, restrained joints gaskets, fasteners and other accessories.
2. Brochures and technical data of coatings and lining's and proposed method of application.

1.05 QUALITY ASSURANCE

A. Inspection and Testing at foundry shall be done in accordance with ANSI Standards.

B. Owner reserves right to inspect and/or test by independent service at manufacturer's plant or elsewhere at his own expense.

C. Owner reserves the right to perform visual inspection and hammer test prior to installation.

PART 2 PRODUCTS

2.01 PIPE

A. Ductile-Iron Pipe
1. Designed in accordance with AWWA/ANSI C150/ A21.50.
2. Manufactured in accordance with AWWA/ANSI C151/A21.51.
3. Unless otherwise indicated or specified, ductile-iron pipe shall be at least thickness Class 52

B. Pipe For Use With Couplings
1. Pipe for use with sleeve-type couplings shall be as specified above except that the ends shall be plain (without bells or beads) cast or machined at right angles to the axis.

2.02 FITTINGS

A. General
1. Push-on or mechanical-joint fittings shall be all-bell fittings unless otherwise indicated or specified.

2. Compact fittings in accordance with AWWA/ANSI C153/A21.53 and shall have a working pressure rating of 350 psi

B. Nuts and Bolts
   1. Ductile Iron or Kor-10 steel T bolts and nuts or approved equal.

C. Nonstandard Fittings
   1. Fittings having nonstandard dimensions and cast especially for this project shall be of acceptable design.
   2. Manufactured to meet the requirements of these specifications and shall have the same diameter and thickness as standard fittings, but their laying lengths and types of ends shall be determined by their positions in the pipelines and by the particular piping to which they connect.

2.03 ADAPTERS

A. Where it is necessary to joint pipes of different type, furnish and install the necessary adapters unless solid sleeves are indicated on the drawings or permitted. Adapters shall have ends, conforming to the above specifications for the appropriate type of joint, to receive the adjoining pipe. Adapters joining two classes of pipe may be of the lighter class provided that the annular space in bell-and-spigot type joints will be sufficient for proper jointing.

2.04 JOINTS

A. Push-On and Mechanical
   1. In accordance with AWWA/ANSI C111/A21.11.
   2. The plain end of push-on pipe shall be factory machined to a true circle and chamfered to facilitate fitting the gasket.
   3. Push-on and mechanical-joint pipe and fittings shall be provided with sufficient quantities of accessories conforming to AWWA/ANSI C111/A21.11.
   4. At the Contractors option, joints in buried pipelines shall be either push on joints or mechanical joints.

B. Restrained
   1. Restraining glands will be required on all fittings.
   2. Pipe, fittings and appurtenances for restrained joints shall be in accordance with AWWA/ANSI C153/A21.53 for compact fittings. Only restraining glands which impart multiple wedging action against the pipe increasing its pressure as the pipe pressure increases will be allowed. Flexibility of the joint shall be maintained after burial. Glands shall be manufactured of ductile iron conforming to ASTM A536. Twist off nuts shall be used to insure proper actuating of the restraining device.
   3. Mechanical joint restraint shall have a working pressure rating of at least 250 psi.
   4. Manufactured by EBAA Iron, Inc., Eastland, Texas, or equal.

C. Gaskets
   1. Gaskets shall be of a composition suitable for exposure to the product which the pipe is intended.

2. All ductile iron pipe installed in contaminated areas, as indicated on the plans, or as directed by the Engineer shall have nitrile / Buna-N (NBR) gaskets.

2.05 COUPLINGS

A. Flexible Connections
   1. Where flexible connections in the piping are specified or indicated on the drawings, they shall be obtained by the use of sleeve-type couplings, split couplings, or mechanical-joint pipe and/or fittings as herein specified.

B. Cast Sleeve Type Couplings
   1. Pressure rating at least equal to that of the pipeline in which they are to be installed.
   2. Provide Style 441 manufactured by Smith Blair, Inc., Texarkana, Texas, or approved equal.
   3. Provided with galvanized-steel bolts and nuts, unless noted otherwise.
   4. All couplings shall be provided with gaskets of a composition suitable for exposure to the liquid within the pipe.
   5. All gaskets provided with metallic tips for electrical continuity through joints.

C. Solid Sleeve Couplings
   1. Solid sleeve couplings and accessories shall be of a pressure rating at least equal to that of the pipeline in which they are to be installed.
   2. Couplings shall be ductile iron with gaskets of a composition suitable for exposure to the liquid within the pipe.

2.06 ACCESSORIES

A. Tapped Connections
   1. Tapped connections in pipe and fittings shall be made in such manner as to provide a watertight joint and adequate strength against pullout. The maximum size of taps in pipe or fittings without bosses shall not exceed the listed size in the appropriate table of the Appendix to the above-mentioned ANSI A21.51 based on 3 full threads for cast iron and 2 full threads for ductile iron.

   2. Where the size of the connections exceeds that given above for the pipe in question, a boss shall be provided on the pipe barrel, the tap shall be made in the flat part of the intersection of the run and branch of a tee or cross, or the connection shall be made by means of a tapped tee, branch fitting and tapped plug or reducing flange, or tapping tee and tapping valve, all as indicated or permitted by the Engineer.

   3. All drilling and tapping of cast-iron pipe shall be done normal to the longitudinal axis of the pipe; fitting shall be drilled and tapped similarly, as appropriate. Drilling and tapping shall be done only by skilled mechanics. Tools shall be adapted to the work and in good condition so as to produce good, clean-cut threads of the correct size, pitch, and taper.

2.07 POLYETHYLENE ENCASEMENT

A. In accordance with AWWA C105 and as indicated on the drawings..

2.08 PIPE INSULATION

A. General
   1. All pipe installed whereby the depth to the springline of the pipe is 4’ below finished grade or less shall be insulated unless otherwise directed by the Engineer.

B. Material
   1. Insulation shall be cellular glass insulation manufactured in accordance with ASTM C552 as manufactured by Owens-Corning Fiberglass Corp., Dow Chemical Co., Johns-Manville Corp., or approved equal.
   2. Insulation shall be secured in place with Type 304 S.S. bands, 9” on center (3/8” minimum width x 0.15” minimum thickness) Flaps at longitudinal and butt joints of factory-wrapped (fiberglass fabric wrapping) insulation shall be cemented in place with waterproof cement.
   3. A fiberated asphalt coating shall be applied to the fiberglass fabric wrapped insulation to a dry thickness of 1/8”. Coating shall be Insulmatic’s 4010, Cary Insulation Seal, Gilsonmatic, or approved equal.

2.09 FINISHES

A. Lining
   1. Inside of pipe and fittings shall be coated with double thickness cement lining and bituminous seal coat conforming to AWWA/ANSI C104/A21.4.

B. Coating
   1. Outside of pipe and fittings shall be coated with the standard bituminous coating conforming to AWWA/ANSI C151/A21.51
   2. Outside surfaces of castings to be encased in concrete shall not be coated.
   3. Machined surfaces shall be cleaned and coated with a suitable rust-preventative coating at the shop immediately after being machined.

PART 3 EXECUTION

3.01 HANDLING

A. Pipe and Fittings
   1. Every care shall be taken in handling and laying pipe and fittings to avoid damaging the pipe, scratching or marring machined surfaces, and abrasion of the pipe coatings.
   2. Any fitting showing a crack and any pipe or fitting which has received a severe blow that may have caused an incipient fracture, even though no such fracture can be seen, shall be marked as rejected and removed at once from the Work.
   3. In any pipe showing a distinct crack and in which it is believed there is no incipient fracture beyond the limits of the visible crack, the cracked portions, if so approved, may be cut off by and at the expense of the Contractor before the pipe

is laid so that the pipe used is perfectly sound. The cut shall be made in the sound barrel at a point at least 12-inches form the visible limits of the crack.

3.02 CUTTING

A. Pipe
1. Except as otherwise approved, all cutting shall be done with a machine having rolling wheel cutters, knives, or saws adapted to the purpose. Hammer and chisel or so-called wheel span cutters shall not be used to cut pipe. All cut ends shall be examined for possible cracks caused by cutting.
2. Cut ends to be used with push-on joints shall be carefully chamfered to prevent cutting the gasket when the pipe is laid or installed.

3.03 INSTALLATION

A. Pipe and Fittings
1. No defective pipe or fittings shall be laid or placed in the piping, and any piece discovered to be defective after having been laid or placed shall be removed and replaced by a sound and satisfactory piece.
2. Each pipe and fitting shall be cleared of all debris, dirt, etc., before being laid and shall be kept clean until accepted in the complete work.
3. Pipe and fittings shall be laid accurately to the lines and grades indicated on the drawings or required. Care shall be taken to ensure a good alignment both horizontally and vertically.
4. Pipe shall have a firm bearing along its entire length.
5. The deflection of alignment at a joint shall not exceed the appropriate permissible deflection as specified in the tabulation titled PIPE DEFLECTION ALLOWANCES.

PIPE DEFLECTION ALLOWANCES

Maximum permissible deflection, in.*

Size of pipe, in.	push-on joint	Mechanical joint
4	19	31
6	19	27
8	12**	12**
10	12 **	12**
12	12**	12**
14	11	12**
16	11	12**
18	11	11
20	11	11
24	11	9
30	11	9
36	11	8

42	7-1/2	7-1/2
48	7-1/2	7-1/2

*Maximum permissible deflection for 18-ft. lengths; maximum permissible deflections for other lengths shall be in proportion of such lengths to 18 ft.

** Per City of Framingham's Requirements.

6. When mechanical joint, push-on joint or similar pipe is laid, the bell of the pipe shall be cleaned of excess tar or other obstructions and wiped out before the cleaned and prepared spigot of the next pipe is inserted into it. The new pipe shall be shoved firmly into place until properly seated and held securely until the joint has been completed.

B. Castings
   1. Castings to be encased in masonry shall be accurately set with the bolt holes, if any, carefully aligned.
   2. Immediately prior to being set, castings shall be thoroughly cleaned of all rust, scale and other foreign material.

C. Temporary Plugs
   1. At all times when pipe laying is not actually in progress, the open ends of pipe shall be closed by temporary watertight plugs or by other approved means. If water is in the trench when work is resumed, the plug shall not be removed until all danger of water entering the pipe has passed.

D. Appurtenances
   1. Valves, fittings and appurtenances shall be set and jointed as indicated on the drawings.

3.04 ASSEMBLING

A. Push-On Joints
   1. Make up by inserting the gasket into the groove of the bell and applying a thin film of special nontoxic gasket lubricant uniformly over the inner surface of the gasket which will be in contact with the spigot end of the pipe.
   2. The chamfered end of the plain pipe shall be inserted into the gasket and then forced past it until it seats against the bottom of the socket.

B. Bolted Joints
   1. Before the pieces are assembled, rust-preventive coatings shall be removed from machined surfaces.
   2. Pipe ends, sockets, sleeves, housings, and gaskets shall be thoroughly cleaned and all burrs and other defects shall be carefully smoothed.

C. Mechanical Joints
   1. Surfaces against which the gasket will come in contact shall be thoroughly brushed with a wire brush prior to assembly of the joint. The gasket shall be cleaned. The gasket, bell, and spigot shall be lubricated by being washed with soapy water.
   2. The gland and gasket, in that order, shall be slipped over the spigot, and the spigot shall be inserted into the bell until it is correctly seated.

3. The gasket shall then be seated evenly in the bell at all points, centering the spigot, and the gland shall be pressed firmly against the gasket.
4. After all bolts have been inserted and the nuts have been made up finger tight, diametrically opposite nuts shall be progressively and uniformly tightened all around the joint to the proper tension, preferably by means of a torque wrench.
5. The correct range of torque as indicated by a torque wrench and the length wrench (if not a torque wrench) used by an average man to produce such range of torque, shall not exceed the values specified in the tabulation titled TORQUE RANGE VALUES.

TORQUE RANGE VALUES

Nominal pipe size, in.in.	Bolt diameter, ft.-lb.	Range of torque, in.	Length of wrench,
3	5/8	40-60	8
4 thru 24	3/4	60-90	10
30, 36	1	70-100	12
42, 48	1-1/4	90-120	14

If the effective sealing of the joint is not attained at the maximum torque indicated above, the joint shall be disassembled and thoroughly cleaned, then reassembled. Bolts shall not be over stressed to tighten a leaking joint.

D. Restrained Joints
   1. Install in accordance with manufacturers written instructions.
   2. Do not exceed manufacturer's permissible pipe deflection allowance.

E. Sleeve-Type Couplings
   1. Prior to the installation of sleeve-type couplings, the pipe ends shall be cleaned thoroughly for a distance of 8-inches
   2. Soapy water may be used as a gasket lubricant.
   3. A follower and gasket, in that order, shall be slipped over each pipe to a distance of about 6-inches from the end, and the middle ring shall be placed on the already laid pipe end until it is properly centered over the joint.
   4. The other pipe end shall be inserted into the middle ring and brought to proper position in relation to the pipe already laid.
   5. The gaskets and followers shall then be pressed evenly and firmly into the middle ring flares.
   6. After the bolts have been inserted and all nuts have been made up finger tight, diametrically opposite nuts shall be progressively and uniformly tightened all around the joint, preferably by use of a torque wrench of the appropriate size and torque for the bolts. The correct torque as indicated by a torque wrench shall not exceed the manufacturers recommended values.
   7. After assembly and inspection and before being backfield, all exterior surfaces of buried sleeve-type couplings, including the middle and follower rings, bolts, and nuts, shall be thoroughly coated with an approved heavy-bodied bituminous mastic. Care shall be taken and appropriate devices used to ensure that the undersides, as well as the more readily accessible parts, are well coated.

3.05 POLYETHYLENE ENCASEMENT

A. When required, install in accordance with AWWA C105.

3.06 SOCKET PIPE CLAMPS, TIE RODS AND BRIDLES

A. Where indicated or necessary to prevent joints or sleeve couplings from pulling apart under pressure, suitable pipe clamps, tie rods or bridles shall be provided. Bridles and tie rods shall be at least 3/4 in. diameter except where they replace flange bolts of smaller size, in which case they shall be fitted with a nut on each side of the pair of flanges. The socket clamps, tie rods or bridles shall be coated with an approved bituminous paint after assembly or if necessary, prior to assembly.

3.07 THRUST BLOCKS

A. Where approved, bends, tees, and other fittings in pipelines buried in the ground may be backed up with Class B concrete placed against undisturbed earth where firm support can be obtained. Thrust blocks shall be constructed in accordance with details in the Contract Documents. If the soil does not provide firm support, then restraining devices shall be provided.

3.08 CLEANING

A. Prior to the pressure and leakage tests, thoroughly clean piping of all dirt, dust, oil, grease and other foreign material. This work shall be done with care to avoid damage to linings and coatings.

3.09 TESTING

A. In accordance with Specification Section 02704 – Pipeline Pressure and Leakage Testing

3.10 DISINFECTING AND FLUSHING

A. In accordance with Specification Section 02675 – Disinfection of Water Mains

3.11 SAMPLING

A. In accordance with Specification Section 02675 – Disinfection of Water Mains

3.12 POST CONSTRUCTION WALK-THROUGH

A. Following activation of the new water main, the Contractor shall participate in a “walk through” of the project with the Owner and/or Engineer to ensure that all valves affected as a result of the project are open and operational.

3.13 CONNECTIONS TO EXISTING WATER MAINS

A. In general, no connection to existing water mains will be allowed prior to the new water main successfully passing pressure and bacteria tests that can be verified with written confirmation. Any exception to this requirement will be at the sole discretion of the Engineer and/or Owner.

END OF SECTION

SECTION 02619

VALVES, HYDRANTS, AND FITTINGS

PART 1 GENERAL

1.01 SUMMARY

A. Section includes

1. Requirements to furnish and install valves, hydrants and miscellaneous piping appurtenances, as indicated on the Drawings and as herein specified.
2. The Drawings and Specifications direct attention to certain features of the equipment, but do not purport to cover all the details of their design. The equipment furnished shall be designed and constructed equal to the high quality equipment manufactured by such firms as are mentioned hereinafter, or as permitted by the Engineer. The Contractor shall furnish and install the equipment complete in all details and ready for operation.

B. Related Sections

1. Section 02215 - Aggregate Materials
2. Section 02200- Earth Excavation, Backfill, Fill and Grading
3. Section 02618 - Ductile Iron Pipe and Fittings
4. Section 03300 - Cast-in-Place Concrete

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM)

1. A48, Standard Specification for Gray Iron Castings
2. A536, Standard Specification for Ductile Iron Castings

B. American Water Works Association (AWWA)/American National Standards Institute (ANSI)

1. ANSI/ASME B2.4-1966 (R1974), Hose Coupling Screw Threads.
2. ANSI/ASME B1.20.7, Hose Coupling Screw Threads
3. ANSI/AWWA C500, Standard for Metal-Seated Gate Valves for Water Supply Service.
4. ASNI/AWWA C502, Dry-Barrel Fire Hydrants
5. ANSI/AWWA C504, Rubber-Sealed Butterfly Valves

6. ANSI/AWWA C509, Resilient-Seated Gate Valves for Water-Supply Service
7. AWWA C550, Protective Epoxy Interior Coatings for Valves and Hydrants

1.03 SUBMITTALS

A. Submit in accordance with Section 01300 – Submittals

1. Manufacturer's specifications, catalog data, descriptive matter, illustrations, diagrams etc.
2. Operating instructions and parts list.

1.04 QUALITY ASSURANCE

A. Contractor is responsible for verifying outside diameter of pipe to be tapped.

B. Coatings in contact with water, which is contiguous with any part of municipal water system, are suitable for use in contact with potable water, provided governing authorities approve and harmful chemicals, taste or odor is not imparted to water when cured.

PART 2 PRODUCTS

2.01 RESILIENT SEAT GATE VALVES

A. Manufactured by American Flow Control, Birmingham AL; Kennedy Valve, Elmira, N.Y. or acceptable equivalent.

B. General

1. Gates shall conform to all applicable sections of AWWA C509.
2. Valve bodies shall be manufactured of ductile iron.
3. Gate valves shall be open **LEFT** (counter clockwise).
4. All valves shall be allowed upper replacement of upper “O” rings while the valve is under pressure in a fully-opened position.
5. Exterior surfaces of all valves shall be coated with a minimum of three applications of an approved bituminous solution, on a rust-free casting, prior to shipment. Valve interiors shall have a two-part thermostat epoxy-protective coating system and meet all requirements of AWWA C550. The epoxy coating shall not impart taste or odors to the water. The coating shall be a product acceptable to the NSF for use in potable water and shall be so listed in the most current NSF summary of approved products (ANSI/NSF Standard 61). The coating shall be applied and cured in strict conformance with the coating manufacturer’s cautions and instructions. The coating shall be applied by the

valve manufacturer under controlled factory conditions, and field application is strictly prohibited.

C. All valves shall be designed for 250 psi working water pressure.

D. Buried Valves:

1. Buried valves shall be of the inside-screw type with mechanical-joint ends. An operating nut and extension stem shall be in lieu of hand wheel.
2. The Contractor shall provide the gate boxes and 2-in. square operating nut at the upper end with coupling connected to the valve stem as required.

2.02 BUTTERFLY VALVES

A. Manufactured by Mueller Co., Decatur, IL; H. Pratt Co., Aurora, Ill., Clow Valve Co., Oskaloosa, IA, or acceptable equivalent.

B. Valve Provisions:

1. Valves shall conform to the requirements as specified in the AWWA Standard for Rubber-Seated Butterfly Valves AWWA C504, except as modified or supplemented herein.
2. The valve design shall utilize a continuous rubber lining on the internal body surfaces and extending over the flanges. A disk which seats at an angle to the axis of the pipe will not be acceptable.
3. Mechanical-joint-end type valves shall be utilized, and shall be constructed of ASTM A536, grade 65-45-12 ductile iron.
4. Valves shall be designed for 250 psi working pressure.
5. Butterfly valves shall be open **LEFT** (counter clockwise).
6. The number of turns will be determined by the Owner.

C. The valve shall utilize body mechanical joint ends in accordance with AN Standard of Rubber Gasket Joints for Cast Iron and Ductile Iron pressure pipe and fittings (A21.11).

D. Seat Provisions:

1. The valve shall utilize a molded natural rubber or synthetic rubber seat on the disk or in the body, and be mechanically fastened, not penetrated by the shaft. Type 316 stainless steel shall be utilized in the mating-seat. The seat shall be replaceable on 12-in. through 24-in. without removing the disk. It shall be mounted securely for complete immobility under operating conditions.
2. If the seat is on the disk, use a Class 40 cast iron disk conforming to ASTM A48, or a Grade 60-40-18 ductile iron conforming to ASTM A536.

3. If the seat is on the body, use a Class 40 cast iron disk conforming to ASTM A48, or a Grade 60-40-18 ductile iron conforming to ASTM A536, with a Type 316 stainless-steel seating edge, or all Type 316 stainless steel. The stainless-steel edge on cast iron or ductile iron disks shall be either mechanically secured or heat shrunk to the edge of the disk or welded overlay.

E. Disk Provisions: The disk shall rotate 90 degrees from full open to full close position.

F. Shaft Provisions: The shaft shall be manufactured from either Type 304 or Type 316 stainless steel. It must be a one-piece unit extended completely through the valve disk.

G. Miscellaneous Provisions: Type 304 stainless steel, taper pins, lock washers and nuts shall be utilized. The packing gland shaft seal shall be a one-piece cast-iron gland follower with bronze nuts. It shall be self-adjusting, split V-type, packing.

H. Valve Operator Provisions: Buried valves shall be provided with gate boxes and operating wrenches as hereinafter specified. Where necessary, valves shall be furnished with steel extension stems or universal joint operating rods with 2-in. square operating nuts at the upper end and a suitable coupling to connect to the valve stem.

I. Buried or Submerged Service Provisions: Valves shall have permanent chevron "V" type packing requiring no adjustment, with self-compensating and self-adjusting seals, under pressure, for buried and submerged service.

2.03 TAPPING SLEEVES

A. Tapping sleeves shall be American Darling model 1004, manufactured by American Flow Control, Birmingham, Ala.; or an approved equivalent.

B. Tapping sleeves shall be of the mechanical joint type. The valve shall be flanged by mechanical joint outlet with non-rising stem and designed for vertical burial. Tapping valves shall be rated at 200 PSI working pressure and shop tested at 300 PSI. Bolts an bonnet and stuffing box shall be 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).

2.04 HYDRANTS

A. The Owner has standardized on American Darling Model No. B-62B Quickfix type of thread – NST as manufactured by American Flow Control.

B. Provisions:

1. Hydrants shall have a minimum working pressure of 200 PSI. Hydrant design shall be of positive automatic drain type to prevent freezing.
2. Hydrant design shall be in accordance with AWWA C502, be suitable for buried depth as indicated and be of positive automatic drain type to prevent freezing.
3. The hydrant shall have a 5 1/4-inch valve opened by turning the operating unit in the counter clockwise direction. The hydrant shall have one 4-1/2-in. pumper and two 2-1/2-in. hose connections. The hose and pumper connections shall have National Standard Thread. The operating nuts shall be pentagonal in shape, 1-1/2-in. from point to opposite flat and shall open **LEFT** (counter clockwise). The hydrant shall be the hub or mechanical-joint type having a 6-in. pipe connection.
4. The rods shall be permanently sealed from contact with water. The hydrant valve shall seal against the bronze hydrant seat.
5. The upper barrel shall be ductile iron with markings identifying size, model and year of the hydrant manufacture.
6. The lower barrel shall be ductile iron.
7. The upper barrel shall connect to the lower barrel with a breakable traffic flange and 8 bolts and nuts. This connection shall allow 360 degree rotation of the upper nozzle section.
8. The hydrant shall have a bronze drain ring securely held between the barrel and base flange. It shall provide bronze to bronze threaded connection for hydrant seal. The bronze drain ring shall serve as a non-corrosive multi-port drain.

2.05 VALVE BOXES

A. Provisions:

1. Valve boxes shall be Buffalo or Erie style, telescoping, heavy pattern type with the lower part manufactured of cast iron and the upper part of steel or cast iron. The valve box shall be designed and constructed to prevent direct transmission of traffic loads to the pipe or valve. Boxes shall be adjustable through at least 6-in. vertically without reduction of lap between sections to less than 4-in. inside diameter of boxes for valves at least 4-1/2 in. and at least 3-in. for stops, and lengths as necessary for depths of the valves or stops with which the boxes are to be used. The top of the cover shall be flush with the top of the box rim. The cover shall have the words “FRAMINGHAM WATER DEPARTMENT” cast into the top for all gates. There shall also be “HYD” cast for hydrant gates, “DIV” cast for pressure division gates and “B.O.” for Blow-off as appropriate.

2.06 T-HANDLE OPERATING WRENCHES

A. Provisions: A T-handle operating wrenches shall be provided in the number and lengths required, but not exceeding 8-ft., to permit operation of all valves and stops by operators of average height working in normal positions.

PART 3 EXECUTION

3.01 VALVES

A. Erect and support valves in respective positions free from distortion and strain on appurtenances during handling and installation. Inspect the material for defects in workmanship and material. Clean out debris and foreign material from valve openings and seats, test-operating mechanisms to check proper functioning, and check nuts and bolts for tightness. Repair, at no additional compensation, valves and other equipment that do not operate easily or are otherwise defective.

B. Appropriate blocking shall be placed under each valve to insure against settlement. Blocking with wood is not acceptable.

C. Valves installed with stems below the horizontal will not be allowed.

D. Set plumb and support valves adequately in conformance with instructions of manufacturer.

E. Provide valves with extension stems where required for convenience of operation. Provide extension stems for valves installed underground and elsewhere so that the operating wrench does not exceed 8 ft. in length.

F. Conduct a final walk through with Owner and Engineer to ensure that all valves are open unless otherwise noted on the contract drawings or directed by the engineer.

3.02 HYDRANTS

A. Set hydrants plumb, and center buried valve and valve box. Tamp earth fill carefully around the valve box to a distance of 4 ft. on all sides of the box, or to undisturbed trench face, if less than 4 ft. Install at least the same depth of cover on hydrant and connecting pipe as on the distributing main. Set the hydrant upon a slab of stone or concrete not less than 4-in. thick and 14-in. square. Firmly wedge side of hydrant opposite pipe connections against vertical face of trench with concrete thrust block. Place not less than 7 cu. ft. of crushed stone around the base of the hydrant at the location of drain holes. Backfill around hydrants as specified under Section 02200. Clean hydrant and valve interiors of all foreign matter before installation and inspect in opened and closed positions. Care must be taken to keep the drain ports clear.

B. Conduct a final walk through with the Owner and Engineer to ensure that all hydrant valves are open

3.03 VALVE BOXES

A. Provide a valve box for each buried stop and valve. Install as detailed on the Drawings

3.04 PAINTING

A. Touch-up abraded areas of shop coat with paint of the same type as shop coat, even to the extent of applying entire coat if necessary, and clean deteriorated surfaces before applying touch-up coat.

B. Shop coat exposed ferrous surfaces, not painted, with grease or other suitable protective coating. Uncoated surfaces in contact with potable water shall not be coated.

C. Hydrants shall be painted with Sherman William paint in accordance with Town's color scheme that is as follows:

1. Hydrant Body: Hydrant Blue – b54tz104
2. Hydrant Caps: Pure White – b54w2101

END OF SECTION

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SECTION 02622

POLYVINYL CHLORIDE GRAVITY SEWER PIPE

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes

1. Requirements for furnishing, installing and testing polyvinyl chloride (PVC) gravity sewer pipe and fittings.

B. Related Sections

1. Section 02200 - Earthwork
2. Section 02215 - Aggregate Materials

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM) Publications

1. D3034, Specification for Type PSM Poly (vinyl chloride) (PVC) Sewer Pipe and Fittings.
2. D3212, Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.
3. F477, Specification for Elastometric Seals (Gaskets) for Joining Plastic Pipe.
4. F679, Specification for Poly (vinyl chloride) (PVC) Large - Diameter Plastic Gravity Sewer Pipe and Fittings.

1.03 SUBMITTALS

A. Shop Drawings

1. In accordance with SECTION 01300 - SUBMITTALS.
2. Submit for review shop drawings showing pipe dimensions, joints, joint gaskets, and other details for each size of pipe to be furnished for the project.
3. All pipe furnished under the contract shall be manufactured only in accordance with the Specifications and the reviewed drawings.

B. Samples

1. Submit samples of products if requested by the Engineer.

1.04 QUALITY ASSURANCE

A. Certifications

1. All pipe delivered to the job site shall be accompanied by test reports certifying that the pipe and fittings conform to the herein-mentioned ASTM specifications.
2. Pipe shall be subject to thorough inspection and tests, the right being reserved for the Engineer to apply such tests as he deems necessary.

3. All tests shall be made in accordance with the methods prescribed by the herein-mentioned ASTM specifications, and the acceptance or rejection shall be based on the test results.
4. Assist the Engineer in inspecting the pipe upon delivery.
5. Pipe not conforming to the requirements of this contract will be rejected and shall be immediately removed from the site by the Contractor.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Storage and Protection

1. All pipe shall be stored at the site until installation in accordance with the manufactures recommendations.

PART 2 PRODUCTS

2.01 MATERIALS

A. Pipe, Fittings, and Specials

1. Diameters 4-inch through 15-inch, in conformance with ASTM D3034.
2. Diameters 18-inch through 27-inch in conformance with ASTM F679, stiffness (PS) 175 psi
3. The pipe shall have pipe diameter to wall thickness ratio (SDR) of a maximum of 35, unless otherwise indicated and/or approved by the Engineer.

B. Straight Pipe

1. Lengths of not more than 13 ft...

C. Y-branches

1. Lengths of not more than 3 ft., unless otherwise permitted by the Engineer.
2. Saddle Y-branches will not be allowed.

D. Specials

1. Conform to the specifications for straight pipe as applicable and to the details indicated on the drawings or bound into the back of the specifications.

E. Joints

1. Conforming to ASTM D3212.
2. Push-on bell and spigot joints using elastomeric ring gaskets

F. Gaskets

1. Conforming to ASTM F477.
2. Securely fixed into place in the bells so that they cannot be dislodged during joint assembly.
3. Composition and texture which is resistant to common ingredients of sewage and industrial wastes, including oils and groundwater, and which will endure permanently under the conditions of the proposed use.

G. Lubricant

1. In accordance with manufacturers requirements.

PART 3 EXECUTION

3.01 PREPARATION

A. Inspection of Pipe

1. Inspect each pipe unit before being installed.
2. No single piece of pipe shall be laid unless it is generally straight and undamaged.
3. The centerline of the pipe shall not deviate from a straight line drawn between the centers of the openings at the ends of the pipe by more than 1/16 in. per ft. of length.
4. If a piece of pipe fails to meet this required check for straightness, it shall be rejected and removed from the site.
5. Any pipe unit or fitting discovered to be defective either before or after installation shall be removed and replaced with a sound unit.

B. Handling of Pipe

1. Each pipe unit shall be handled into its position in the trench, by such means as acceptable to the Engineer. Care shall be taken to avoid damaging the pipe and fittings.

3.02 INSTALLATION

A. Placement

1. Except as otherwise indicated on the drawings, support pipe with compacted Crushed Stone in accordance with Specification SECTION 02215. No pipe or fitting shall be permanently supported on saddles, blocking, or stones.
2. Provide suitable depressions in crushed stone to accept pipe bells, so that after placement, only the barrel of the pipe receives bearing pressure from the supporting material.
3. Clear pipe and fittings of debris, dirt, etc., before being installed; keep clean until accepted in the completed work.
4. Install pipe and fittings to the lines and grades indicated on the drawings or as required by the Engineer. Care shall be taken to ensure true alignments and gradients.

B. Joining Pipe

1. Before any joint is made, the previously installed unit shall be checked to assure that a close joint with the adjoining unit has been maintained and that the inverts are matched and conform to the required grade.
2. The pipe shall not be driven down to the required grade by striking it with a shovel handle, timber or other unyielding object.
3. All joint surfaces shall be cleaned. Immediately before jointing the pipe, the bell or groove shall be lubricated in accordance with the manufacturer's recommendation.
4. Each pipe unit shall then be carefully pushed into place without damage to pipe or gasket.
5. Suitable devices shall be used to force the pipe units together so that they will fit with a minimum open recess inside and outside and have tightly sealed joints.
6. Care shall be taken not to use such force as to wedge apart and split the bell or groove ends.
7. Joints shall not be "pulled" or "cramped" unless permitted by the Engineer.
8. Where any two pipe units do not fit each other closely enough to enable them to be properly jointed, they shall be removed and replaced with suitable units.
9. Gasket installation and joint assembly shall follow the directions of the manufacturers of the joint material and of the pipe, all subject to review by the Engineer. The resulting joints shall be watertight and flexible.

10. Open ends of pipe and branches shall be closed with polyvinyl chloride stoppers secured in place in an acceptable manner.

C. Rejecting Pipe

1. Pipe of a particular manufacturer may be rejected if there are more than five unsatisfactory joint assembly operations or "bell breaks" in 100 consecutive joints, even though the pipe and joint conform to the appropriate ASTM Specifications as hereinbefore specified. If the pipe is unsatisfactory, as determined above, the Contractor shall, if required, remove all pipe of that manufacturer of the same shipment from the work and shall furnish pipe from another manufacturer which will conform to all of the requirements of these specifications.

D. Bedding Pipe

1. After each pipe has been properly placed, enough crushed stone shall be placed between the pipe and the sides of the trench, and thoroughly compacted, to hold the pipe in correct alignment.
2. Bell holes (depressions), provided for jointing, shall be filled with crushed stone and compacted, and then crushed stone shall be placed and compacted to complete the pipe bedding, as indicated on the drawings.

E. Protecting Pipe

1. Take all necessary precautions to prevent flotation of the pipe in the trench.
2. Close the open ends of the pipe with temporary watertight plugs; at all times pipe installation is not in progress.
3. If water is in the trench when work is to be resumed, the plug shall not be removed until suitable provisions have been made to prevent water, earth, or other substances from entering the pipe.
4. Pipelines shall not be used as conductors for trench drainage during construction.

F. Backfilling Pipelines

1. In accordance with SECTION 02200.

3.03 ALLOWABLE PIPE DEFLECTION

A. Pipe provided under this specification shall be installed not exceeding a maximum deflection of 3.5 percent. Deflection shall be computed by multiplying the amount of deflection (nominal diameter less minimum diameter when measured) by 100 and dividing by the nominal diameter of the pipe.

B. Upon completion of a section of sewer, including placement and compaction of backfill, the Contractor shall measure the amount of deflection by pulling a specially designed gauge assembly through the completed section. The gage assembly shall be in accordance with the recommendations of the pipe manufacturer and be acceptable to the Engineer.

C. Should the installed pipe fail to meet this requirement, the Contractor shall do all work to correct the problem as the Engineer may require without additional compensation.

3.04 CLEANING

A. Care shall be taken to prevent earth, water, and other materials from entering the pipeline. As soon as possible after the pipe and manholes are completed, clean out the pipeline and manholes, being careful to prevent soil, water, and debris from entering any existing sewer.

3.05 FIELD QUALITY CONTROL

A. Pipeline Flushing

1. Care shall be taken to prevent earth, water, and other materials from entering the pipe... As soon as possible after the pipe and manholes are completed on any street, flush out the new pipeline, using a rubber ball ahead of the water, flushing water or debris will not be permitted to enter any existing sewer.

B. Inspection by Light

1. The alignment of the pipe will be checked by shining a flashlight through the pipe from one manhole to the adjacent manhole. The inspector must be able to see the full circumference of the lighted pipe for its entire length when looking through the pipe from the adjacent manhole towards the manhole from which the light is being emitted.

C. Leakage Tests

1. The pipeline shall be made as nearly watertight as practicable, and leakage tests and measurements shall be made after the pipeline has been backfilled.
2. Where the groundwater level is more than 1 ft. above the top of the pipe at its upper end, the Contractor shall conduct either infiltration tests or low pressure air tests.
3. Where the groundwater level is less than 1 ft. above the top of the pipe at its upper end, conduct either exfiltration tests or low-pressure air tests.
4. At the time of the test, determine the groundwater elevation from observation wells, excavations or other means, all subject to review by the Engineer.
5. For making the infiltration and exfiltration tests, furnish suitable test plugs, water pumps, and appurtenances, and all labor required to properly conduct the tests on sections of acceptable length.
6. The sewers shall be tested before any connections are made to buildings.
7. Provide all instruments, weirs, bulkheads, water and equipment required to test the sewer.
8. Should the sections under test fail to meet the requirements, the Contractor shall do all work of locating and repairing leaks and retesting as the Engineer may require without additional compensation.
9. If, the in the judgment of the Engineer, it is impracticable to follow the procedures specified in this Specification for any reason, acceptable modifications in the procedures shall be made as required, but in any event, the Contractor shall be responsible for the ultimate tightness of the line.

D. Low Pressure Air Test

1. For making the low-pressure air tests, use equipment specifically designed and manufactured for the purpose of testing sewer pipelines using low-pressure air. The equipment shall be provided with an air regulator valve or air safety so set that the internal air pressure in the pipeline cannot exceed 8 psig.
2. The leakage test using low pressure air shall be made on each manhole-to-manhole section of pipeline after placement of the backfill.

3. Pneumatic plugs shall have a sealing length equal to or greater than the diameter of the pipe to be tested. Pneumatic plugs shall resist internal test pressures without requiring external bracing or blocking.
4. All air used shall pass through a single control panel.
5. Low-pressure air shall be introduced into the sealed line until the internal air pressure reaches 4 psig. greater than the maximum pressure exerted by the groundwater that may be above the invert of the pipe at the time of the test. However, the internal air pressure in the sealed line shall not be allowed to exceed 8 psig. When the maximum pressure exerted by the groundwater is greater than 4 psig. conduct only an infiltration test.
6. At least two minutes shall be allowed for the air pressure to stabilize in the section under test. After the stabilization period, the low-pressure air supply hose shall be quickly disconnected from the control panel. The time required in minutes for the pressure in the section under test to decrease from 3.5 to 2.5 psig (greater than the maximum pressure exerted by groundwater that may be above the invert of the pipe) shall not be less than that shown in the following table:

Pipe diameter in inches	Minutes	Pipe diameter in inches	Minutes
6	3.0	18	9.0
8	4.0	21	10.0
10	5.0	24	11.5
12	5.5	27	13.0
15	7.5		

E. Infiltration Test

1. For making the infiltration tests, underdrains, if used, shall be plugged and other groundwater drainage shall be stopped to permit the groundwater to return to its normal level insofar as practicable.
2. Upon completion of a section of the sewer, dewater it and conduct a satisfactory test to measure the infiltration for at least 24 hours. The amount of infiltration, including manholes, tees, and connections, shall not exceed 100 gal. per inch diameter per mile of sewer per 24 hours.

F. Exfiltration Test

1. For making the exfiltration tests, the sewers shall be subjected to an internal pressure by plugging the pipe at the lower end and then filling the pipelines and manholes with clean water to a height of 2 ft. above the top of the sewer at its upper end. Where conditions between manholes, may result in test pressures which would cause leakage at the stoppers in branches, provisions shall be made by suitable ties, braces, and wedges to secure the stoppers against leakage resulting from the test pressure.
2. The rate of leakage from the sewers shall be determined by measuring the amount of water required to maintain the level 2 ft. above the top of the pipe.
3. Leakage from the sewers under test shall not exceed the requirements for leakage into sewers as hereinbefore specified.

END OF SECTION

SECTION 02627

POLYVINYL CHLORIDE PIPE FOR LOW PRESSURE SEWERS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes

1. Requirements to furnish, install, and test polyvinyl chloride (PVC) pressure pipe, fittings, and appurtenant materials to be used as low pressure sewers.

B. Related Sections

1. Section 02200 - Earth Excavation, Backfill, Fill and Grading
2. Section 02215 - Aggregate Materials
3. Section 02629 - Underground Utility Marking Tape

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM)

1. D1784, Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride (CPVC) Compounds.
2. D2241, Specifications for Poly (Vinyl Chloride) (PVC) Pressure Rated Pipe (SDR-Series).
3. D3139, Specification for Joints for Plastic Pressure Pipe Using Flexible Elastometric Seals.

1.03 SUBMITTALS

A. Submit in accordance with SECTION 01300.

1. Shop Drawings
   a. Drawings showing pipe dimensions, joints, joint gaskets, restrainment and other details for each size of pipe to be furnished for the project.
   b. Submit lay schedule delineating types and locations of restrainment.
2. Samples
   a. Submit samples of products if requested by the Engineer.

1.04 QUALITY ASSURANCE

A. Certifications

1. All pipe delivered to the job site shall be accompanied by test reports certifying that the pipe and fittings conform to the referenced ASTM specifications.

B. Testing

1. The pipe shall be subject to thorough inspection and tests, the right being reserved for the Engineer to apply such tests as he deems necessary.
2. All test shall be made in accordance with he methods prescribed by the herein -mentioned ASTM specifications, and the acceptance or rejection shall be based on the test results.

1.05 DELIVERY, STORAGE AND PROTECTION

A. Pipe will be inspected upon delivery, and such as does not conform to the requirements of this Contract shall be rejected and shall immediately be removed by the Contractor.

B. Store pipe at the site until installation, in accordance with the manufacturer's recommendations.

1.06 PROJECT/SITE CONDITIONS

A. Existing Conditions

1. Verify that field measurements and elevations are as indicated.

PART 2 PRODUCTS

2.01 MATERIALS

A. Pipe

1. Polyvinyl Chloride (PVC) pressure pipe shall conform to the requirements of ASTM D2241 for Class 200, SDR 21 pipe.
2. Manufactured from clean, virgin, approved Class 12454 compounds, conforming to ASTM D1784, with an established hydrostatic design minimum of 2,000 psi for water at 73 degrees. F.
3. Pipe shall be furnished in maximum 20 foot laying lengths with integral bell joints formed so as to contain a rubber sealing gasket.
4. Joints to be Push-on bell and spigot conforming to the requirement of ASTM D3139.

B. Fittings

1. Fittings for use with polyvinyl chloride (PVC) pressure pipe shall be push on joint, conforming to ASTM D3139.
2. Joints shall conform to the requirements of ASTM D3139.
3. Fittings shall be of a pressure classification at least equal to that of the piping with which they are to be used.
4. Fittings related to low pressure sewer structures shall be as detailed on the Drawings.

C. Gaskets

1. Composition and texture which is resistant to common ingredients of sewage and industrial wastes, including oils and groundwater, and which will endure permanently under the conditions of the proposed use.

D. Lubricants

1. In accordance with manufacturers requirements.

E. Marking

1. All pipe shall be properly marked by the manufacturer in accordance with ASTM D2241. Markings shall be spaced at intervals of not more than five feet and shall include the following:

a. Nominal pipe size
b. Type of material with designation code
c. Pipe diameter to wall thickness ratio
d. ASTM designation with which pipe complies
e. Manufacturer's name or trademark and code

2.02 UNDERGROUND UTILITY MARKING

A. In accordance with Specification SECTION 02629.

PART 3 EXECUTION

3.01 INSTALLATION

A. Inspection of Pipe

1. No defective pipe or fittings shall be laid or placed in the piping, and any piece discovered to be defective after having been laid or placed shall be removed and replaced by a sound and satisfactory piece.

B. Handling

1. Each pipe shall be handled into its position in the trench only in such a manner, and by means as acceptable to the Engineer. Care shall be taken to avoid damaging the pipe fittings.

C. Installation

1. Each pipe and fitting shall be cleared of all debris, dirt, etc., before being laid and shall be kept clean until accepted in the complete work.
2. In buried pipelines, each pipe shall have a firm bearing along its entire length.
3. Except as otherwise indicated on the drawings, the pipe shall be supported by compacted screened gravel. No pipe or fitting shall be permanently supported on saddles, blocking, or stones. Screened gravel shall be in accordance with SECTION 02215.
4. Suitable bell holes shall be provided, so that after placement, only the barrel of the pipe receives bearing pressure from the supporting material.

5. If cutting is necessary the pipe shall be cut by means of a conventional hand or power saw or an acceptable pipe cutter in accordance with the recommendations of the manufacturer. All field cut ends shall be square and beveled to duplicate the machining of the factory ends as closely as possible in accordance with the recommendations of the manufacturer.
6. Provide restrainment as required to keep joints from separating under working and test pressure.

D. Joining the pipe

1. Before any joint is made, the previously installed unit shall be checked to assure that a close joint with the adjoining unit has been maintained and that the inverts are matched and conform to the required grade. The pipe shall not be driven down to the required grade by striking it with a shovel handle, timber or other unyielding object.
2. All joint surfaces shall be cleaned. Immediately before jointing the pipe, the bell or groove shall be lubricated in accordance with the manufacturer's recommendation. Each pipe unit shall be then carefully pushed into place without damage to pipe or gasket. Suitable devices shall be used to force the pipe units together so that they will fit with a minimum open recess inside and outside and have tightly sealed joints. Care shall be taken not to use such force as to wedge apart and split the bell or spigot ends.
3. Joints shall not be "pulled" or "cramped" unless permitted by the Engineer.
4. Where any two pipe units do not fit each other closely enough to enable them to be properly jointed, they shall be removed and replaced with suitable units and new gaskets.
5. Details of gasket installation and joint assembly shall follow the directions of the manufacturer, all subject to review by the Engineer.

E. Bedding Pipe

1. After each pipe has been properly placed, enough gravel shall be placed between the pipe and the sides of the trench, and thoroughly compacted, to hold the pipe in correct alignment.
2. Bell holes (depressions), provided for jointing, shall be filled with screened gravel and compacted, and then screened gravel shall be placed and compacted to complete the pipe bedding, as indicated on the Drawings.

F. Protection of Pipe

1. Take all necessary precautions to prevent flotation of the pipe in the trench.
2. At all times pipe installation is not in progress, the open ends of the pipe shall be closed with temporary watertight plugs, or by other acceptable means.
3. If water is in the trench when work is to be resumed, the plug shall not be removed until suitable provisions have been made to prevent water, earth, or other substances from entering the pipe.
4. Pipelines shall not be used as conductors for trench drainage during construction.

G. Backfilling Pipelines

1. In accordance with SECTION 02200.

3.02 FIELD QUALITY CONTROL

A. Pressure and Leakage Tests

1. Except as otherwise directed, all pipelines shall be given combined pressure and leakage tests in sections of suitable length.

2. Furnish and install suitable temporary testing plugs or caps; all necessary pressure pumps, pipe connections, meters, gages, relief valves, and other necessary equipment: and all labor required.

3. Subject to the permission of the Engineer and provided that the tests are made with a reasonable time considering the progress of the project as a whole, and the need to put the section into service, the Contractor may make the tests when he desires.

4. Fill the section of pipe to be tested with water of acceptable quality. All air shall be expelled from the pipe. If blowoffs are not available at high points for releasing air then make the necessary taps at such points. Plug said holes after completion of the test.

5. The section under test shall be maintained full of water for a period of 24 hours prior to the combined pressure and leakage test being applied. The pressure and leakage test shall consist of first raising the water pressure (based on the elevation of the lowest point of the section under test and corrected to the gage location) to a pressure in pounds per square inch numerically equal to the pressure rating of the pipe but not to exceed 160 psi. Care shall be taken not to apply this pressure to items of equipment known to be incapable of withstanding such pressure.

6. If specified pressure cannot achieve and maintained for a period of one hour with no additional pumping, the section shall be considered as having failed to pass the test.

7. If the section fails to pass the pressure and leakage test, locate, uncover, and repair or replace the defective pipe, fitting, or joint, all at the Contractors expense and without extension of time for completion of the work. Additional tests and repairs shall be made until the section passes the specified test and is considered acceptable by the Engineer.

8. If, in the judgment of the Engineer, it is impracticable to follow the foregoing procedure exactly for any reason, modifications in the procedure may be made as required and permitted by the Engineer, but in any event the Contractor shall be fully responsible for the ultimate tightness of the line within the above leakage and pressure requirements.

3.03 CLEANING

A. Prior to the pressure and leakage tests, the piping shall be thoroughly cleaned of all dirt, dust, oil, grease and other foreign material. This work shall be done with care to prevent soil, water and debris from entering any existing sewer.

3.04 UNDERGROUND UTILITY MARKING TAPE

A. Install as detailed in the Contract Documents.

END OF SECTION

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SECTION 02675

DISINFECTION OF WATER MAINS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This section includes the following:

1. Disinfection of pipelines.
2. Dechlorination of discharged water.

B. Related sections

1. Section 01300 – Submittals
2. Section 01400 – Quality Assurance
3. Section 02704 – Pipeline Pressure and Leakage Testing.

1.3 SYSTEM DESCRIPTION

A. Disinfect all water main and appurtenances installed under this Contract, including new water mains and temporary water bypass mains. Disinfection shall occur only after successful pressure and leakage testing according to Section 02704 – Pipeline Pressure and Leakage Testing.

B. Pipeline disinfection shall be performed in conjunction with the related work items of dewatering, testing, flushing and discharge of chlorinated water, prior to placing newly installed water main in service. The Contractor's responsibility shall include, but not be limited to, the following:

1. Provision of the chlorine product for disinfection at the rate and dose specified shall be in accordance with AWWA standards.
2. Provision of pipeline taps for dosing and testing of chlorinated water, as necessary.
3. Labor and equipment necessary to dispense the dose of chlorine at points and rates as directed by the Engineer.
4. Labor and equipment to operate newly installed mainline valves, air release valves, and blowoff valves as necessary and directed by the Engineer. Operation of valves allowed in accordance with 1.3.E.

5. Labor, materials and equipment necessary to dechlorinate the treated water prior to discharge.

D. The Contractor shall be responsible for disinfecting and putting into service new water mains and temporary water bypass mains.

E. Contractor shall not operate valves or hydrants on the existing or new water system when it is in service as part of Framingham's water system. All valve and hydrants on the active system shall be operated solely by Framingham Department of Public Works Water Department staff.

F. Contractor shall be responsible for coordinating all activities with the Owner and Engineer.

G. All disinfection and bacteriological sampling and testing shall be performed by a third-party subcontractor to the Contractor who has been pre-approved by the Engineer.

1.4 REFERENCES

A. AWWA B300, Hypochlorites

B. AWWA C651, Disinfecting Water Mains

1.5 SUBMITTALS

A. Shop Drawings: Submit the following in accordance with Paragraph 6.17 of the General Conditions and Section 01300 – Submittals:

1. Prior to the installation of new water main, including temporary bypass water system and the new permanent water system, the Contractor shall submit to the Engineer a written work plan describing his proposed work. The work plan shall include, but not be limited to, the following:

a. List of main segments by valve or station locations.

b. Identification of the pipe diameter and lengths to be tested.

c. Confirmation that the continuous feed method will be used in disinfecting the mains and a full description of how that method will be used.

d. Chlorine feed location(s).

e. Chlorine agent to be utilized.

f. Material Safety Data Sheets (MSDS) for all chemicals to be used.

g. Chlorine batching calculations to show required level of chlorine being added to the mains.

h. Flushing methods listing pipe diameter, length, flushing time calculations and locations of flushing feed and outlets.

i. Methods of measuring chlorine solution being added to the pipe and after it has been added.

j. Sample collection techniques.

k. Name and qualifications of the third-party sampling subcontractor.

l. Name of MADEP certified laboratory proposed to perform the tests.

m. Dechlorination methods, including dechlorination agent and locations.

2. Contractor shall modify work plan to address comments and/or revisions required by the Engineer in accordance with Section 01300 – Submittals at no additional cost to the Owner.

3. No disinfection work shall commence until Engineer approves the work plan.

1.6 PROJECT/SITE CONDITIONS

A. All water shall be discharged in accordance with local, state and federal regulations.

B. The Contractor shall coordinate work with the Owner, and provide assistance as required for the Owner, to collect duplicate samples for additional testing using the required third-party sampling subcontractor.

1.7 SEQUENCING AND SCHEDULING

A. Coordinate operation of existing valves, timing and duration of shut-down of existing mains, and disinfecting, and re-energizing of the water main with the Engineer and where applicable with the Owner, including notification of the following prior to the stated work:

1. Valve Operations: The Contractor shall notify Engineer a minimum of three (3) working days prior to stated work.

a. Only Framingham Water Department personnel are allowed to operate valves and hydrants in service as part of the active Framingham water system, whether those valves and hydrants are pre-existing or newly installed.

2. Pressure and leakage testing: The Contractor shall successfully complete pressure and leakage testing to the satisfaction of the Engineer and Owner prior to commencing disinfection.

3. Disinfecting and Flushing: The Contractor shall notify Engineer three (3) days prior to stated work.

a. Notification shall include location of work, length and diameter of the pipe to be disinfected and other pertinent information.

PART 2 PRODUCTS

2.1 MATERIALS

A. Calcium hypochlorite shall conform to AWWA B300.

1. Granules with 70 percent available chlorine.

B. Liquid sodium hypochlorite shall conform to AWWA B300.

C. Backflow preventer devices (reduced pressure devices) for the purpose of disinfection to be provided by the Owner.

D. Line purge dechlorinator with dechlorination tablets. Dechlorinator shall have 2-1/2 inch NPT coupling and capacity flow rates of up to 1,600 GPM. Dechlorination tablets shall be ascorbic acid, sodium sulfite or sodium thiosulfate, capable of dechlorinating the flushed water.

E. Chlorine residual analyzer – MEL/850 by Hach or equal.

PART 3 EXECUTION

3.1 PREPARATION

A. General:

1. Perform disinfection in accordance with latest version of AWWA C651.
2. The Engineer will review disinfection procedure, designate dosage and will perform necessary water quality tests to verify that disinfection has been accomplished according to public health standards.
3. Owner-approved backflow preventer shall be installed in the line to prevent backflow or siphonage of water into the existing water system.

B. Flushing:

1. Confirm with Framingham Water Department that water of sufficient quantity and pressure is available for flushing prior to performing flushing as specified here:
   a. Prior to chlorination, mains shall be properly flushed by the Contractor, coordinating the operation of hydrants with the Owner. The Contractor shall not operate hydrants and shall contact the Owner at least 48 hours prior to flushing to enable the Owner to have sufficient time for Water Department personnel to perform hydrant operation.
   b. In accordance with AWWA C651-14, flushing shall be performed at a flow rate required to achieve a minimum velocity of 3 feet per second (approximately 470 GPM in an 8-inch main, 1,060 GPM in a 12-inch main and 1,880 GPM in a 16-inch main). One or more hydrants may be required to be opened in order to achieve the minimum flushing flow rates.
   c. Flushing shall be performed for a sufficient period of time to allow for a minimum of 3 volume changes of water in the main (approximately 20 minutes per 1,000-foot of main at the above flow rates).

C. Discharge:

1. Prior to the start of flushing and dechlorination, measure the chlorine concentration in the Framingham water system in the vicinity of the work to establish the ambient concentration representing the goal for achieving dechlorination.
2. Water with high concentrations of chlorine (residual greater than the ambient concentration described in Paragraph 3.1.C.1) shall be dechlorinated to the ambient concentration or lower prior to any discharge.
3. Dechlorination shall be conducted by use of a line purge dechlorinator. Dechlorination shall be in accordance with the manufacturer's instructions and AWWA C651, Section 4.9.

3.2 DISINFECTANT

A. Calcium Hypochlorite:

1. Use only as a solution.
2. Pump into pipe with a suitable chemical feed pump.

3.3 APPLICATION

A. Disinfection, Sampling, and Testing

1. Disinfection and sampling shall be performed by the Contractor's third-party subcontractor. The Contractor will be allowed to use the same third-party subcontractor for disinfection and sampling as for leakage and pressure testing, provided that the subcontractor is qualified to do both.
2. Flushing and dechlorination prior to discharge shall be performed by the Contractor, coordinating with the Owner's staff.

B. Special Techniques:

1. Disinfect pipes only by the continuous feed method. The slug method shall not be used. Follow procedures in the latest version of AWWA C651, with the following specific restrictions.
    a. Continuous feed method:
        (1) Feed chlorine into pipe so that the feed solution entering contains a maximum of 50 mg/l of available chlorine.
        (2) Apply chlorine continuously all sections of the pipe have a minimum concentration of 25 mg/l of available chlorine.
        (3) Retain treated water in pipe for at least 24 hours.
        (4) Confirm that chlorine residual at end of test is at least 10 mg/l.
        (5) Coordinate with Owner to operate all valves and hydrants to insure disinfection. Manipulate valves to prevent super chlorinated water

from entering existing distribution system.

b. Swabbing

(1) New pipe, fittings, and valves that are less than 20 feet in length and cannot be disinfected as part of the disinfection of the new water system as a whole may be spray disinfected and swabbed according to AWWA C651 Paragraph 4.10.

3.2 FIELD QUALITY CONTROL

A. Tests:

1. Measure chlorine levels with meters or color-wheel. Paper chlorine test strips, Hach or equal, are acceptable methods for determining chlorine levels. Pool chlorine test strips are not acceptable.
2. Bacteriological test samples shall be collected by the Contractor's third-party subcontractor after the chlorine solution has been flushed out of the pipe.
3. Sampling frequency shall be as required in AWWA C651 5.1.1.2, at a minimum, plus additional samples at the beginning of the line being tested (one initial and one additional as outlined below).
4. Disinfection shall be repeated, as necessary at no additional cost to the Owner, to produce satisfactory bacteriological samples.
5. Sampling shall follow "Option B" in AWWA C651 (Paragraph 5.1.1.1), with initial samples taken sixteen (16) hours after the main has been dechlorinated and flushed and then additional samples at least 15 minutes apart while leaving sample taps running and without additional flushing.
6. The results of the tests on these samples will determine the acceptance and allow these new mains to be connected to the Owner's system. Written laboratory test results shall be furnished to the Engineer and Owner. In accordance with AWWA C651 5.1.6, Contractor may flush and re-sample immediately after first failure. Subsequent failure of any sample to pass the laboratory tests shall require the Contractor to re-flush and rechlorinate the mains and re- sample and test the water until acceptable results are obtained, all at no additional cost to the Owner.
7. Samples collected from water main shall be tested for Total Coliform, Heterotrophic Plate Count (HPC), and free chlorine. The following results would indicate successful disinfection / dechlorination:
    a. Total Coliform = 0
    b. HPC < 500 CFY/mL
    c. Free chlorine <= system residual chlorine concentration

B. Water Main Activation:

1. Bacteriological and pressure test data shall be submitted to the Engineer for review before water mains that were tested are activated.
2. Upon receipt of satisfactory bacteria sample test results and successful pressure tests, the Contractor shall coordinate with the Owner and Engineer to have the Owner's personnel operate all valves required to place mains in service.
3. Contractor shall note that Work under this Contract shall not be considered completed until satisfactory installation and testing of the water mains have been completed.
4. Once the testing has been successfully completed, all corporations installed for disinfection purposes shall be closed and plugged. All tubing shall be removed.

END OF SECTION

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SECTION 02704

PIPELINE PRESSURE AND LEAKAGE TESTING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This section includes the following:

1. Perform field hydrostatic pressure and leakage testing of water main pipe.
2. Prepare and submit final test result report.

B. Related sections include the following:

1. Section 01300 – Submittals
2. Section 02618 – Ductile Iron Pipe and Fittings for Water Main
3. Section 02675 – Disinfection of Water Mains
4. Section 02736 - Temporary Water Bypass

1.3 SYSTEM DESCRIPTION

A. Pipe installed as water main under Section 02618 shall be tested in accordance with Article 13 of the General Conditions and with the requirements of this section.

B. Gravity sewer main or storm drains shall NOT be tested under this section.

1.4 REFERENCES

A. AWWA C651, Disinfecting Water Mains

B. ANSI/AWWA C600, Installation of Ductile-Iron Water Mains and Their Appurtenances

1.5 SUBMITTALS

A. Shop Drawings: Submit the following in accordance with Section 01300 – Submittals

1. Name and qualifications of the third-party leakage and pressure testing subcontractor.
2. Testing schedule and test procedure.

a. Indicate proposed time and sequence of testing on schedule.

b. Indicated test procedure requirements as follows:

(1) Limits of each pipe to be tested.
(2) Position of all valves during testing.
(3) Location of temporary bulkheads.
(4) Other applicable procedures.

1.6 SEQUENCING AND SCHEDULING

A. Complete pressure and leakage testing of pipes prior to final cleaning and disinfection; Engineer shall be present during all testing.

1. Notify Engineer of time and place of testing at least five (5) days prior to commencement of work.

PART 2 PRODUCTS

2.1 EQUIPMENT

A. Provide test equipment as follows:

1. Piping connections between pipe tested and water source.
2. Equipment, materials, and facilities required to perform specified tests including but not limited to the following:
   a. Pumping equipment
   b. Water meter
   c. Calibrated pressure gauges
3. Sectionalizing devices required including but not limited to the following:
   a. Flanges
   b. Valves
   c. Bulkheads
   d. Bracing
   e. Blocking
   f. Restraints

PART 3 EXECUTION

3.1 PREPARATION

A. Provide blocks, anchors, and supports for pipe being tested and adjacent existing pipe, valves and fittings before test pressure is applied.

3.2 INSTALLATION

A. Water:

1. Schedule filling of line with Engineer at least five (5) days in advance of testing.
2. Do not allow water to enter other parts of the pipeline, not subject to testing, unless approved by the Engineer.
3. Coordinate with Engineer to dispose of test water in accordance with Section 02675 – Disinfection of Water Mains.

B. Venting:

1. Confirm that air release valves and other venting devices are installed according to the Contract Documents and in accordance with the manufacturers' instructions and are placed in open position when filling pipe with water.
2. Do not close hand-operated vent valves until water flows in an uninterrupted stream from each valve.

3.3 APPLICATION

A. Third-Party Testing

1. Leakage and pressure testing shall be performed by the Contractor's third-party subcontractor.

B. Pressure Testing:

1. All pipe and appurtenances installed shall be hydrostatically tested in accordance with ANSI/AWWA C600, latest version, unless stated otherwise herein.
    a. Test pressure shall be measured and applied at the elevation of horizontal center line of pipe at selected location.
    b. Confirm pressure gauges are accurately calibrated.
    c. Do not attempt pressure testing until all air has been vented from the mains.
2. All new water mains which shall become the property of the Owner shall be pressure tested at 200 psi for a continuous period of two hours.
3. After applying test pressure, wait until pressure stabilizes before starting test.

C. Leakage Testing:

1. Conduct leakage testing in conjunction with pressure tests.
2. Confirm that joints in piping are watertight and free from visible leaks during leakage test.

3. Leakage Test Pressure:

    a. Maintain specified test pressure for pressure testing of reach during leakage test.

    b. Maintain hydrostatic pressure within plus or minus 5 psi during entire time of leakage measurements.

4. Leakage Measurement:

    a. Do not attempt measurement of leakage until pipe has been filled and allowed to sit for 24-hours, trapped air has been vented and constant test pressure has been established.

    b. Measure leakage by means of an approved calibrated barrel on the suction side of the pump.

        (1) Confirm that water barrel is accurately calibrated.

5. Allowable Leakage:

    a. Pump the main to specified test pressure. When pressure is reached, stop pump. If pressure drops 5 psi or more, start pump and measure the quantity of water required to maintain the specified pressure. Repeat this process as required.

    b. Ensure that pipe reach does not exceed the allowable leakage rate and does not exceed the allowable hydrostatic variation specified in Paragraph 3.3.C3b.

    c. Calculate allowable leakage with following formula:

        Q = 0.0068 DLN where

        Q = allowable leakage in gallons per hour

        D = nominal diameter of pipe in inches

        L = length of section tested in thousand feet (1000-foot maximum). Where line valves are spaced further than 1,000-feet, the actual distance of the spacing shall be allowed.

        N = square root of avg. test pressure in psi (N=12.25 for 150 psi test pressure; N=10.00 for 100 psi test pressure). The following table is derived from that calculation for specific pressures and pipe diameters.

Hydrostatic Testing Allowance per 1,000 Feet of Pipeline - gallons per hour

Average Test	Nominal Pipe Diameter in Inches												
Pressure (psi)	3	4	6	8	10	12	14	16	18	20	24	30	36
300	0.35	0.47	0.71	0.94	1.18	1.41	1.65	1.88	2.12	2.36	2.83	3.53	4.24
275	0.34	0.45	0.68	0.90	1.13	1.35	1.58	1.80	2.03	2.26	2.71	3.38	4.06
250	0.32	0.43	0.65	0.86	1.08	1.29	1.51	1.72	1.94	2.15	2.58	3.23	3.87
225	0.31	0.41	0.61	0.82	1.02	1.22	1.43	1.63	1.84	2.04	2.45	3.06	3.67
200	0.29	0.38	0.58	0.77	0.96	1.15	1.35	1.54	1.73	1.92	2.31	2.88	3.46
175	0.27	0.36	0.54	0.72	0.90	1.08	1.26	1.44	1.62	1.80	2.16	2.70	3.24
150	0.25	0.33	0.50	0.67	0.83	1.00	1.17	1.33	1.50	1.67	2.00	2.50	3.00
125	0.23	0.30	0.46	0.61	0.76	0.91	1.06	1.22	1.37	1.52	1.82	2.28	2.74
100	0.20	0.27	0.41	0.54	0.68	0.82	0.95	1.09	1.22	1.36	1.63	2.04	2.45

d. If a length of main consists of various diameters, calculate allowable leakage (Q) separately for each diameter and its respective length. The minimum calculated allowable leakage rate obtained shall be the allowable leakage (Q) for the entire reach of main being tested.

e. If testing of multiple valved sections is allowed, the allowable leakage for each valved segment shall be calculated and the minimum value obtained shall be the allowable leakage allowed (Q) for the entire length of main being tested.

f. If multiple valved sections are tested, each valve in the segment shall be closed and pressure tested for a minimum of 15-minute period. This testing is in addition to the pressure and leakage testing specified herein.

g. Measure and record volume of water pumped into main to maintain test pressure. If actual volume exceeds the allowable, Contractor shall stop test, repair leaks, and retest, all at no additional cost to the Owner.

3.4 FIELD QUALITY CONTROL

A. Inspection:

1. Locate defective joints and pipe materials during pressure testing.
2. Locate and repair leaking joints, valves and other defective items of work to reduce pipe leakage to a rate less than or equal to that which is specified for the pipe or valve. Repairs shall be made at no additional cost to the Owner.

B. Repairs

1. Repairs to pipelines shall require removal of the defective section of pipe, joint, valve or fitting.
2. New materials to replace those replaced as described above shall be installed with mechanical joint solid sleeves. All mechanical joints shall be installed with restraints as specified in Section 02618 – Ductile-Iron Pipe and Fittings for Buried Service.
3. For water mains, disinfect the repair section in accordance with AWWA C651, ANSI/NSF Standard 61, and Section 02675 – Disinfection of Water Mains.

C. Upon completion of repairs, Contractor shall repeat the pressure-leakage test until satisfactory results are obtained, at no additional cost to the Owner.

D. All repairs, including labor, materials, equipment, traffic details, paving and other related costs required to locate and repair defective work shall be performed at no additional cost to the Owner.

E. Upon completion of the pressure testing, submit complete written documentation of the testing to the Engineer. Report shall be neatly prepared and bound. Copies of field notes are not acceptable for this requirement. Documentation shall consist of the following:

1. Dates, time and sequence of testing.
2. List and description of all equipment used in the testing.
3. Names of personnel who conducted the testing.
4. Test procedure requirements as follows:
    a. Limits of each pipe tested.
    b. Position of all valves during testing.
    c. Leakage calculations (theoretical and actual)
    d. Other applicable procedures.
5. Test results by segment listing test pressure and amount of makeup water.
6. Description of leaks repaired and method used to make repairs.

F. Release of final retainage will be withheld until receipt of satisfactory test result data by the Engineer.

END OF SECTION

SECTION 02831

CHAIN LINK FENCING

PART 1 – GENERAL.

1.01 SUMMARY

A. Section Includes
   1. Requirements for chain link fences, including gates, posts and post foundations, hardware and appurtenances, of various types and configurations at the locations indicated on the Drawings or as directed by the Engineer, all in accordance with this Specifications.

B. General Requirements
   1. The Contractor shall provide all labor, equipment, materials and accessories necessary to install all chain link fence and gate.

C. Related Sections
   1. The Contractor shall provide all labor, equipment, materials and accessories necessary to install all chain link fence and gate.
   2. 01300 – Submittals
   3. 03300 – Cast-in-Place Concrete

1.02 REFERENCES

A. AASHTO M181 – Chain-Link Fence

B. "Standard Specifications for Road and Bridge Construction" of the Rhode Island Department of Transportation, latest revision, herein referred to as "State Standards".

1.03 SUBMITTALS

A. Submittals for all products incorporated into this work shall be made in accordance with the requirements as specified in Section 01300, SUBMITTALS.

B. The Contractor shall submit the following to the Engineer for approval:
   1. Three samples, approximately 6 inches long or 6 inches square, of fabric material, post section, and typical accessories.
   2. Shop drawings showing fence height, sizes of posts, rails, braces, gates, footings, accessories, bending strengths, and assembly.
   3. Manufacturer’s certified test data demonstrating compliance with all performance specifications for color coating of framework and fabric.

1.04 QUALITY CONTROL

A. Shop welding shall be in conformance with the latest AWS standards, and no field welding shall be required.

B. Wire gauges shall conform to American Steel and Wire Co. gauges.

C. Bolts, washers, and nuts shall be galvanized steel in conformance with the requirements as specified in Section 05500, Miscellaneous Metals.

D. Mild steel bars and shapes shall conform to ASTM A36.

E. Unless noted otherwise, fencing and all components are to be color-coated BLACK. Manufacturer shall have a minimum 5 years experience manufacturing thermally-fused chain link fencing and all appurtenances.

PART 2 – PRODUCTS

2.01 GENERAL

A. All fencing and appurtenances shall be provided by a single manufacturer and all components shall match in color as specified.

B. The overall height of ground-mounted fence shall be 8 feet.

C. All fence components including, but not necessarily limited to, framework, hardware, fabric, gates and accessories shall be vinyl-coated as specified. The Contractor shall submit color patterns that will be selected; and the Engineer will select the color. Consistency of color shall be controlled by establishing Munsell color specifications in accordance with ASTM D-1535, and holding colors within tolerances approved by the Engineer.

D. Members having structural sections other than those specified herein may be submitted for the Engineer's consideration of architectural appearance provided that such members have minimum bending strengths equal to those of pipe posts specified herein. Bending strength as used herein is defined as the concentrated force applied eight feet from a cantilever support in which the member is embedded (such as the ground) at which incipient permanent bending deformation results. Where square or roll-formed sections are used, the Contractor shall submit data demonstrating that the sections have minimum bending strengths in all directions equal to those of pipe sections specified herein or are otherwise of adequate bending strength. Manufacturer shall submit test data and/or computations to verify bending strength as part of his shop drawing submittal.

2.02 VINYL-COATED CHAIN LINK FABRIC

A. Vinyl-coated steel chain link fabric shall be No. 9 finished gauge, woven wire, to a uniform square mesh measuring 2±1/8-inches between its parallel sides. Galvanized core wire shall be No. 10-1/2 gauge, of good commercial quality steel and shall be uniformly galvanized with a zinc-coat-weight of at least 0.30 oz per sq. ft. The galvanized wire shall then be coated with a molecular bonding layer and a minimum 20 mil vinyl coating, continuously extrusion-bonded (not sprayed or dipped) by a thermal extrusion-bonding process to insure a dense and impervious covering, free of voids and having a smooth and lustrous appearance. Unbonded coatings are not acceptable. The vinyl coating shall not be capable of being stripped from the wire with wire strippers. The wire shall be vinyl-clad before weaving and shall be free and flexible at all joints. The bond shall exhibit equal or greater strength than the cohesive strength of the vinyl. All cut ends shall be coated with vinyl at the factory during the weaving process.

B. The fabric wire shall have a minimum breaking strength of 850 lbs. when tested per U.S. Government Spec. RR-F—191/1A.

C. The vinyl in the color coating shall be a plasticized polyvinyl chloride (PVC) with low temperature (-20 deg F) plasticizer and no fillers, extenders, or extraneous matter other than the necessary stabilizers and pigments. The PVC shall have a specific gravity of 1.3 (ASTM D792), tensile strength of 2,600 psi minimum (ASTM D412), ultimate elongation of 275 percent (ASTM D412), hardness of 85 minimum Type A durometer (ASTM 2240), and minimum 750 volt dielectric strength per mill (ASTMD149). The color coating shall be stabilized and shall withstand a minimum weatherometer exposure of 1,500 hours without any discolorization or other deterioration (Test Equipment Operating Light and Water Exposure Apparatus Carbon-Arc Type, ASTM D-1499, G23, Type E). The coating shall also withstand an accelerated weatherometer aging test of a minimum of 1,500 hours at 145 deg F (ASTM D1499) without showing signs of fading, cracking, blistering, or splitting. When tested, both before and after the weatherometer tests at temperatures down to –20 deg F, the coating shall remain flexible and shall not rupture, split, or separate from the core wire when bent around a mandrel with a diameter 10 times that of the wire. The vinyl covering shall, in addition, resist attack from prolonged exposure to dilute solutions of most common mineral acids, seawater, and dilute solutions of most salts and alkalis.

D. Fabric shall measure 8 feet in height and be knuckled at top selvage and twisted and barbed at bottom selvage.

E. Fabric shall be fastened to all rails and line posts by means of No. 6 gauge zinc-coated and color-coated wire ties spaced approximately 12 inches O.C. Fabric shall be fastened to end, corner, pull and gate posts by means of zinc and vinyl-coated tension bars, held in place at 12-inch intervals by zinc and vinyl-coated tension bar

bands, nuts, and bolts. Tension bars shall be ¼ inch by ¾ inch and full height of fabric.

2.03 FRAMEWORK AND HARDWARE

A. All framing and accessories shall be provided as required to complete the fence system.

B. All posts, rails, braces, and accessories shall be color-coated. Before color is applied, all materials shall be thoroughly cleaned by effective means to remove all loose mill scale, rust, and foreign matter, and given a protective hot dip galvanized coating inside (where applicable) and outside of not less than 1.8 oz per sq. ft. A chemical cleaning and phosphate conversion treatment shall be used to prepare zinc substrate to receive primer and vinyl coating. A minimum of 10 mils of vinyl coating shall be bonded to the to a special cross-linked epoxy phenolic primer by a thermal fusion process. Unbonded coatings are not acceptable. The resin shall have a specific gravity of 1.3 (ASTM D792), tensile strength of 2,600 psi (ASTM D412), minimum elongation of 200 percent, tear strength of 0.36 lb per mil, hardness of 85 minimum Type A durometer (ASTM D2240), minimum 750 volt dielectric strength per mill (ASTM D149), minimum 160 inch-pound impact under gardner test, volume resistivity of 2.0×10^{12} ohm/cm, and brittle temperature of minus 20 deg. F. The color coating shall be stabilized and shall withstand weatherometer exposure tests (standard ASTM Designation D1499, G23, Type D) as follows: minimum 1,000 hours without discoloration; minimum 5,000 hours without cracking, blistering, or loss of adhesion. The coating shall withstand an accelerated aging test (ASTM D1499) of a minimum of 1,500 hours at 145 deg F without any cracking or peeling, and shall exhibit a maximum shrinkage of 1/16-in. per ft. The color coating shall also withstand a salt spray test (Federal Test Standard 141 – Method 6061) of greater than 10,000 hours, with no perceptive deterioration to coating or evidence of metal corrosion for unscored samples; for scored samples after exposure of 1,000 hours, undercutting shall not exceed 1/8 inch. The protective resin coating shall not exceed 1/8 inch. The protective resin coating shall exhibit a chemical resistance after prolonged exposure at 75 deg. F to fumes and shall, in addition, resist attach from prolonged exposure to dilute solutions of most common mineral acids, sea water, and dilute solutions of most salts and alkalis.

C. Posts and rails shall be Schedule 40 steel pipe, ASTM Designation A-120, having the following approximate outside diameters, and minimum weights per linear foot:

1. Line Posts	2-1/2 inches @ 3.7 lbs.
2. End, Corner, and Pull Posts	3 inches @ 5.8 lbs.
3. Rails	1-5/8 inches @ 2.3 lbs.
4. Gate Posts	4 inches @ 9.1 lbs.

D. Spacing between end, corner, pull, or line posts shall not exceed 10 ft 0-in. Posts of all types shall be of sufficient length to fully support fence fabric height and allow for installation to the depth of footing specified below ground level.

E. Post tops shall be pressed steel or malleable iron, designed to exclude moisture from the posts and receive the top rail.

F. The fence shall have a continuous top rail for its full length. The top rail shall pass through openings provided in the line post tops, and each length shall be coupled with an internal self-centering, swaged sleeve for a distance of 6 inches.

G. Horizontal braces (brace rail) shall be provided where required at all pull, corner, and terminal posts midway between the top rail and ground, and shall extend from pull, corner, and terminal posts to the first adjacent line posts. Braces shall be securely fastened to the line posts, pull, corner, and terminal posts by rail ends and brace bands. Brace rails shall be vinyl-bonded, galvanized steel, 1-5/8 inches outside diameter pipe, weighing not less than 2.3 pounds per linear foot with plain ends. Each corner and pull post shall be braced and trussed on two sides; each terminal post shall be braced and trussed on one side.

H. Diagonal braces (truss rods) shall be provided with all horizontal braces and shall be trussed from the brace ends on the line post back to the bottom of pull, corner or terminal post. The diagonal brace rods shall be galvanized steel, 3/8-inch diameter. Each brace rod shall be provided with a heavy malleable iron hot-dip zinc-coated turnbuckle to provide means for adjusting the tension in the diagonal brace.

2.04 GATES

A. General
   1. Steel gate frames and other steel components shall be color-coated as specified for framework and hardware above. Aluminum gate frames shall be color-coated per manufacturer's recommendations. Painting of hardware and accessories is unacceptable.
   2. The fabric shall be of the same material as for fence, and shall be attached to the gate frame on all four sides by means of vinyl-coated fasteners and tension bars.
   3. For each gate, heavy galvanized hardware and accessories shall be provided and shall include hinges, latches, keepers, and gate stops as appropriate.
   4. Latch shall be forked type or plunger-bar type to permit operation from either side of gate. Provide padlock eyes as integral part of latch.
   5. A bronze padlock, Yale and Towne No. 39-1/2 or equal, shall be furnished for each gate. The padlocks shall all be keyed alike to match the Owner's standard and be approved by the Engineer.

B. Cantilever Sliding Gate
   1. The cantilever sling gate shall be "freehanging" type, single leaf, and sized as shown on the Drawings. The gate manufacturer shall supply sliding gates of

appropriate construction, which will be structurally stable and meeting the intended dimensions. The gate shall be manufactured by Anchor Fence/Master Halco Inc., Cyclone Fence, Page Fence, or approved equal.

2. The gate shall be provided with two roller truck assemblies, which operate within a combined track and top gate frame member. The roller truck assemblies shall provide vertical support and lateral movement control to insure alignment of the truck in the track. The roller truck assemblies shall be fastened to gate posts with 7/8-inch diameter ball bolts with ½-inch shank.
3. The gate frame shall be constructed of 2-inch square aluminum tubing alloy 6063-T6, weighing 0.94 lbs per linear foot, welded at the joints. The combined track and top frame member shall be extruded aluminum-sized per manufacturer's recommendations. The bottom frame member shall be 2-inch by 4-inch aluminum tubing weighting 1.71 pounds per linear foot.
4. Support posts for the cantilever slide gate shall be of 4-inch outside diameter, Schedule 40 steel pipe, ASTM A-120, as specified above.
5. Vertical uprights and diagonal truss rods shall be provided as necessary to insure rigidity of the gate frame and prevent sagging.
6. Appurtenant hardware including roller guide assemblies for each support post, latch assembly with provisions for padlocking, and gate stop assembly shall be provided.

PART 3 - EXECUTION

3.01 GENERAL

A. The Contractor shall perform such clearing as may be necessary to construct the fence to the required grade and alignment shown on the Drawings. Installation of permanent fencing shall not begin until completion of final grading.

B. The new fence shall be permanently tied to the terminals of existing fences where required.

C. Top rails and fabric bottom shall be approximately parallel to final surface grade, allowing no more than 6 inches clear distance between the fabric bottom and grade.

D. At locations of small streams or drainage ditches where it is not practical to conform the fence to the general contour of the ground surface, the Contractor, when directed, shall span the opening below the fence with wire fastened to stakes of such length as required.

E. When directed, the Contractor will be required to stake down the chain link fence at several points between posts.

F. At each location where electric transmission or distribution lines cross any of the types of fences covered by this Specification, the Contractor shall furnish and install a

ground conforming to the requirement of Section 9 of the National Electric Safety Code.

G. Abrasions of color-coating shall be touched up to the Engineer's satisfaction by methods approved in writing to the Engineer. The Engineer reserves the right to require replacement of scratched or otherwise damaged fence components.

3.02 INSTALLATION OF POSTS

A. Posts shall be set plumb, in proper alignment, and embedded in 3,000 psi concrete (State Standard Class A (AE)) unless otherwise specified on the plans or for temporary fencing. Holes for post footings shall be drilled in firm, undisturbed, or compacted soil. Concrete shall be placed in a continuous pour and crowned at top to shed water. Contractor shall install temporary guys, or braces, as may be required to support the posts in proper position until such time as the concrete has set sufficiently to anchor said posts. Concrete footings shall be carried to the depth and dimensions shown on the Drawings.

B. Where rock is encountered within the required depth to which the post is to be erected, a hole of a diameter slightly larger than the largest dimension of the post shall be drilled into the rock and the post grouted in. The regular dimensioned concrete footing as shown on the plans shall then be placed between the top of the rock and required grade shown on the plans.

C. All hollow pipe and tube type post shall be fitted with post tops. The bases of the post tops shall have flanges that fit around the outside of the posts and shall be secured.

D. Pull posts shall be installed at all points of inflection greater than 30 degrees in the line of the fence and at all points of abrupt changes in grade.

3.03 INSTALLATION OF FABRIC

A. The fabric shall be unrolled on the outside of the fence line with the bottom edge of the fabric against the posts. The various rolls shall be spliced to form a continuous mesh pattern by bringing the ends close together and weaving in a picket in such a way that will engage both ends of the rolls and catch, with each twist, each separate mesh of the picket of both rolls of fabric.

B. At end, corner or gateposts, the stretcher bar shall be slipped through the end picket of the fabric and the stretcher bar bands at the same time. The bolts in the stretcher bar bands shall then be tightened. Additional rolls of fabric shall be spliced and placed as the erection progresses along the fence. In long sections, an intermediate pull post with horizontal braces and diagonal braces shall be provided every 500 feet.

C. The fabric shall be placed by securing one end and applying sufficient tension to remove all slack before making attachments elsewhere. After the fabric has been stretched, it shall be attached to the line posts and rails with fabric ties spaced at 12 inches apart. The topmost clip shall be placed on the line post as near the top of the fabric as possible and lowest clip as near the bottom of the fabric as possible. At terminal sections (end, corner and pull) and gateposts, the fabric shall be fastened with stretcher bars and bands. The fastenings shall be spaced at 12 inches on centers for terminal sections (end, corner and pull) and gateposts. The topmost band shall be placed on these posts as near the top of the fabric as possible and the lowest band as near the bottom as possible.

D. Before making a closure, the other end of the run shall be fastened to the end, corner, or gatepost as described previously. The operation of making a closure of a run shall be as follows. The stretching equipment shall be clamped on the ends of the fabric parallel to each other and about 5-feet apart when the tension is first applied. The stretching shall continue until the slack has been removed from both sections of the fabric. If the ends overlap, the fabric shall be cut to match. The ends shall be joined by the insertion of a picket similar to the methods of connecting two rolls of fabric.

3.04 INSTALLATION OF GATES

A. Gates shall be installed plumb, level, and secure for full opening without interference. The gates shall be hung on gate fittings as shown on the plans. Gates shall be erected to slide in the direction indicated and shall be provided with gate stops as shown on the drawings.

3.05 ADDITIONAL INSTALLATION

A. Braces
   1. When top rail is not used, braces shall be placed 12 inches down from the top of the terminal posts and shall extend from the terminal (end, corner, and pull) post and gate posts to the brace post. The braces shall be securely fastened to the post and trussed from brace post back to terminal post with round rod and turnbuckle, all as shown on the drawings.

B. Existing Fence Connections:
   1. Whenever a new fence joins an existing fence, either at a corner or at the intersection of straight line fences, the corner post with brace post shall be set at said junction and braced the same as herein described for corner posts or as shown on the plans. If the connection is made at other than the corner of the new fence, the last span of the old fence shall contain a brace span.

3.06 INSPECTION, TESTS AND GUARANTEES

A. The Engineer shall have the right to inspect and test any materials or their fabrication at any time during construction at the mill, shop or field. At the option of the Engineer, certified mill tests of materials may be accepted in lieu of tests.

B. The Contractor shall furnish to the Engineer, prior to installation, notarized certification and satisfactory guarantees by the fence manufacturer covering any faults and/or defects in any part of the fence arising from defective workmanship or materials for a period of one (1) year, and any rust and corrosion for fifteen (15) years, from the date of final acceptance of the project.

END OF SECTION

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SECTION 02832

ORNAMENTAL FENCE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. This item shall include furnishing materials for and erecting a new FENCE consisting of steel posts with caps, pickets, hardware, and concrete foundation, in the location as shown on the plan and detailed and as further specified herein:

1.02 REFERENCED ITEMS

A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process.

B. ASTM B117 - Practice for Operating Salt-Spray (Fog) Apparatus.

C. ASTM D523 - Test Method for Specular Gloss

D. ASTM D714 - Test Method for Evaluating Degree of Blistering in Paint.

E. ASTM D822 - Practice for Conducting Tests on Paint and Related Coatings and Materials using Filtered Open-Flame Carbon-Arc Light and Water Exposure Apparatus.

F. ASTM D1654 - Test Method for Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments.

G. ASTM D2244 - Test Method for Calculation of Color Differences from Instrumentally Measured Color Coordinates.

H. ASTM D2794 - Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact).

I. ASTM D3359 - Test Method for Measuring Adhesion by Tape Test.

J. ASTM F2408 – Ornamental Fences Employing Galvanized Steel Tubular Pickets.

1.03 REQUIRED SUBMITTALS

A. Submittals shall be in accordance with Section 01300

1. Shop Drawings:
   a. Steel Fence shop drawings showing fence design, layout of fence with dimensions and specified options, including details and finishes of component accessories and post foundations.
2. Product Data:

a. Submit manufacturer's product data, including style, installation instructions and certification of compliance with material specifications.

3. Warranty:
   a. Provide manufacturer's 20 year non-prorated warranty.

1.04 QUALITY ASSURANCE

A. Engage an experienced installer who has at least five years' experience and has completed at least five steel fence projects with the same material and similar scope to that indicated for this project with a successful construction record of in-service performance.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Upon receipt at the job site, all materials shall be checked to ensure that no damage occurred during shipping or handling. Materials shall be stored in such a manner to ensure proper ventilation and drainage, and to protect against damage, weather, vandalism and theft.

PART 2 PRODUCTS

2.01 FENCE

A. Acceptable manufacturers of the FENCE include the following companies below or approved equal to conform to the size, materials, similar pattern design and configuration shown on the plan, details and as specified herein.

B. The fence system shall conform to Montage II 3 Rail 6' height; classic picket space Welded and Rackable (ATF – All Terrain Flexibility) Ornamental Steel, extended picket bottom rail manufactured by Ameristar Fence Products, Inc., in Tulsa, Oklahoma.

C. Color shall be black

D. Steel material for fence panels and posts shall conform to the requirements of ASTM A653/A653M, with a minimum yield strength of 45,000 psi (310 MPa) and a minimum zinc (hot-dip galvanized) coating weight of 0.90 oz/ft2 (276 g/m2), Coating Designation G-90.

E. Material for pickets shall be 1" square x 14 Ga. tubing. The rails shall be steel channel, 1.75" x 1. 75" x .105". Picket holes in the rail shall be spaced 4.715" o.c. Fence posts shall be at a minimum of 12 gauge with dimension of 2.5"x2.5".

F. Pickets, rails and posts shall be pre-cut to specified lengths. Rails shall be pre-punched to accept pickets.

G. Pickets shall be inserted into the pre-punched holes in the rails and shall be aligned to standard spacing using a specially calibrated alignment fixture. The aligned pickets and rails shall be joined at each picket-to-rail intersection by fusion welding process, thus completing the rigid panel assembly

H. The manufactured panels and posts shall be subjected to an inline electrodeposition coating (E-Coat) process consisting of a multi-stage pretreatment/wash, followed by a duplex

application of an epoxy primer and an acrylic topcoat. The minimum cumulative coating thickness of epoxy and acrylic shall be 2 mils (0.058 mm). D. The manufactured fence system shall be capable of meeting the vertical load, horizontal load, and infill performance requirements for Commercial weight fences under ASTM F2408

2.02 CANTILEVER GATE

A. Acceptable manufacturers of the Cantilever Gate include the following companies below or approved equal to conform to the size, materials, similar pattern design and configuration shown on the plan, details and as specified herein.

B. The fence system shall conform to TransPort II 6' height; classic picket space manufactured by Ameristar Fence Products, Inc., in Tulsa, Oklahoma

C. Color shall be black.

D. The materials used for cantilever gate framing (uprights & diagonal bracing) shall be manufactured from ASTM B221 aluminum (designation 6063-T-6) with yield strength of 25,000 PSI, a tensile strength of 30,000 PSI and a standard mill finish. The TransPort™ enclosed tracks shall be manufactured from ASTM B221 aluminum (designation 6063-T-6) with a yield strength of 25,000 PSI, a tensile strength of 30,000 PSI and a standard mill finish.

E. Material for pickets shall be 1" square x 16 ga. steel pickets. Picket on center spacing shall not exceed 5". Pickets shall be securely fastened to face of top and bottom enclosed track extrusions,

F. Steel material for fence posts and pickets shall be galvanized prior to forming in accordance with the requirements of ASTM A653/A653M, with minimum yield strength of 45,000 psi (310 MPa). The steel shall be hot-dip galvanized to meet the requirements of ASTM A653/A653M with a minimum zinc coating weight of 0.90 oz/ft2 (276 g/m2), Coating Designation G-90. Material for gate support posts shall be 4" square x 11 Ga. tubing.

G. Suspension Rollers for enclosed tracks shall be used at each support post to track connection. Each truck assembly shall be capable of being adjusted vertically via threaded rod for fine-tune adjustment. Truck assembly shall be constructed in a way so that the primary housing for the truck rollers shall pivot via ball-bearing connection to threaded rod.

PART 3 EXECUTION

3.01 PREPARATION

A. All new installation shall be laid out by the contractor in accordance with the construction plans.

3.02 INSTALLATION

A. Fence post shall be spaced according to manufacturer's recommendations. For installations that must be raked to follow sloping grades, the post spacing dimension must be measured along the grade. Fence panels shall be attached to posts with brackets supplied by the manufacturer. Posts shall be set in concrete footers having a minimum depth of 36" (Note: In some cases, local restrictions of freezing weather conditions may require a greater depth). The "Earthwork" and "Concrete" sections of this specification shall govern material requirements for the concrete footer. Posts setting by other methods such as plated posts or grouted core-drilled footers are permissible only if shown by engineering analysis to be sufficient in strength for the intended application.

3.03 FENCE INSTALLATION MAINTENANCE

A. When cutting/drilling rails or posts adhere to the following steps to seal the exposed steel surfaces; 1) Remove all metal shavings from cut area. 2) Apply zinc-rich primer to thoroughly cover cut edge and/or drilled hole; let dry. 3) Apply 2 coats of custom finish paint matching fence color. Failure to seal exposed surfaces per steps 1-3 above will negate warranty. Ameristar spray cans or paint pens shall be used to prime and finish exposed surfaces; it is recommended that paint pens be used to prevent overspray. Use of non-Ameristar parts or components will negate the manufactures' warranty.

3.04 CLEANING

A. The contractor shall clean the jobsite of excess materials; post-hole excavations shall be scattered uniformly away from posts.

END OF SECTION

SECTION 02930

LOAMING AND SEEDING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Requirements for loaming, fertilizing, seeding, and related work in areas disturbed in the process of performing the Work under this contract.

1.02 SUBMITTALS

A. In accordance with SECTION 01300 submit the following:

1. Submit with seed, certificates confirming seed mixture, purity, germinating value, and crop year identification.
2. Submit test samples of loam.

1.03 DELIVERY, STORAGE AND HANDLING

A. Fertilizer:

1. Delivered mixed as specified in standard size, unopened containers showing weight, analysis, and name of manufacturer.
2. Store in weather proof place.

B. Seed:

1. Delivered in original unopened containers with mixture listed.

PART 2 PRODUCTS

2.01 LOAM

A. Fertile, natural topsoil, typical of locality, without admixture of subsoil, refuse or other foreign materials, and obtained from well-drained arable site. Mixture of sand, silt and clay particles in approximately equal proportions. Free of stumps, roots, heavy or stiff clay, stones large than 1 inch in diameter, lumps, coarse sand, noxious weeds, sticks, brush or other deleterious matter.

B. Not less than 4 percent nor more than 20 percent organic matter as determined by loss on ignition of oven-dried samples.

C. Loam test samples dried to constant weight at temperature of 230 degrees F., plus or minus nine degrees.

D. Use loam, having prior vegetative growth that did not contain toxic amounts of either acid or alkaline elements.

2.02 LIME, FERTILIZER AND SEED

A. Ground agricultural limestone containing not less than 85 percent of total carbonates.

B. Complete fertilizer, at least 50 percent of nitrogen derived from natural organic sources of ureaform and containing following percentages by weight:

Nitrogen 10% Phosphorus 10% Potash 10%

C. Turf grass seed, clean, high in germinating value and latest year's crop mixture as follows:

Name	Minimum Proportion by Weight	Percent Purity	Percent Germination
Kentucky bluegrass	20%	87%	85%
Merion Kentucky bluegrass	20%	87%	85%
Red Chewings fescue	45%	98%	85%
Italian rye	15%	98%	90%

PART 3 EXECUTION

3.01 GENERAL

A. Supply suitable quantities of water, hose and appurtenances.

3.02 LOAM

A. Spread loam on areas to 6-inch depth after compaction, fine grade and compact.

3.03 LIME, FERTILIZER AND SEEDING

A. Apply lime by mechanical means at rate of 3000 pounds per acre.

B. Apply fertilizer at rate of 1200 pounds per acre.

C. Remove weeds or replace loam and reestablish finish grades, if any delays in seeding lawn areas and weeds grow on surface or loam is washed out prior to sowing seed and without additional compensation. Sow seed at rate of 175 pounds per acre on calm day, by mechanical means. "Hydro-Seeding" not permitted unless otherwise permitted or required by Engineer. Sow one-half of seed in one direction, and other half at right angles to original direction. Rake seed lightly into loam, to depth of not more than 1/4 inch and compact by means of an acceptable lawn roller weighing 100 to 150 pounds per linear foot of width.

D. Water lawn areas adequately at time of sowing and daily thereafter with fine spray, and continue throughout maintenance and protection period.

E. Seed during approximate time periods of April 1 to May 15 and August 15 to October 1, and only when weather and soil conditions are suitable for such work, unless otherwise permitted.

3.04 MAINTENANCE OF SEEDED AREAS

A. Maintain lawn areas and other seed areas at maximum height of 2-1/2 inches by mowing at least three times. Weed thoroughly once and maintained until time of final acceptance. Reseed and refertilize with original mixtures, watering or whatever is necessary to establish over entire area of lawn and other seeded areas a close stand of grasses specified and reasonably free of weeds and undesirable coarse native grasses.

B. Begin maintenance immediately after each portion of lawn is seeded and continue for minimum of 45 days.

C. Repair or replace all seeded areas which, in judgment of Engineer, have not survived and grown in satisfactory manner, for a period of one year after acceptance.

D. Seeding replacement, same seed mixture as specified and furnished and installed as specified.

3.05 TEMPORARY COVER CROP

A. Sow a temporary cover crop of buckwheat, domestic rye grass or other acceptable seed if there is insufficient time in the planting season to complete seeding, fertilizing, and permanent seeding at the option of Contractor or order of Engineer. Cut and water cover crop as necessary until the beginning of the following planting season, at which time it shall be plowed or harrowed into soil, the areas shall be fertilized and permanent seed crop sown as specified.

END OF SECTION

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DIVISION 03

SECTION 03300

CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Requirements for furnishing and installing forms, reinforcing steel, concrete and expansion and/or construction joints

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM)

1. A185, Specification for Steel Welded Wire Fabric, Plain, for Concrete Reinforcement.
2. A615, Specification for deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
3. C31, Practice for Making and Curing Concrete Test Cylinders in the Field.
4. C33, Specification for Concrete Aggregates.
5. C39, Test Method for Compressive Strength of Cylindrical Concrete Specimens.
6. C42, Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
7. C94, Specification for ready Mixed Concrete.
8. C143, Test Method for Slump of Hydraulic Cement Concrete.
9. C150, Specification for Portland Cement.
10. C172, Practice for Sampling Freshly Mixed Concrete.
11. C231, Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
12. C260, Test Method for Air-Entraining Admixtures for Concrete.
13. C494, Specification for Chemical Admixtures for Concrete.
14. C920, Specification for Elastomeric Joint sealants.
15. D994, Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type)
16. D1056, Specification for Flexible Cellular Materials-Sponge or Expanded Rubber.
17. D1751, Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).

B. American Concrete Institute (ACI):

1. ACI 301, Specification for Structural Concrete for Buildings.
2. ACI 304, Recommended Practice for Measuring, Mixing, Transporting, and Placing Concrete.
3. ACI 305, Recommended Practice for Hot Weather Concreting.
4. ACI 306, Recommended Practice for Cold Weather Concreting.
5. ACI 315, Building Code Requirements for Reinforced Concrete.
6. ACI 347, Guide to Formwork for Concrete.

C. Concrete Reinforcing Steel Institute (CRSI):

1. Manual of Standard Practice.

1.03 SUBMITTALS

A. Submit Shop Drawings in accordance with SECTION 01300 for the following:

1. Reinforcing Steel
   a. Furnish in detail and completeness that all fabrication and placement at the site can be accomplished without the use of contract drawings for reference.
   b. Include number of pieces, sizes, and grade of reinforcing steel, accessories, and any other information required for fabrication and placement.
   c. Show joint layout and design
   d. Check structural and site drawings for anchor bolts, anchors, inserts, conduits, sleeves, and any other items which are required to be embedded in concrete, and make necessary provisions as required so that reinforcing steel will not interfere with the placement of such embedded items.
2. Concrete mix designs.
3. Grout manufacturer/design mix (if included in this section)
4. Manufacturer’s data for ancillary materials such as joint fillers and sealants, epoxy bonding compound.

1.04 QUALITY ASSURANCE

A. Selection of testing laboratory in accordance with SECTION 01410.

B. Sample and Test Concrete as follows:

1. Test Specimens: Make, cure and have tested, a minimum of one set of four test specimens from the concrete of each day's pour and for each fifty cubic yards of concrete cast in accordance with ASTM C172, C31 and C39. One cylinder shall be broken after seven days and three cylinders after twenty-eight day.
2. Slump: A slump test shall be made for each truckload of concrete in accordance with ASTM C143. Slumps greater than design mix limit will be grounds for rejection of the concrete.
3. Air Content: An air content test shall be made from each day's pour of concrete by the pressure method in accordance with ASTM C231. Air contents above or below the limits specified will be grounds for rejection of the concrete.
4. In the event the compressive strength of the cylinders, when tested, is below the specified minimum, the Engineer may require test cores of the hardened structure to be taken by the Testing Laboratory in accordance with ASTM C42. If such test indicates that the core specimen is below the required strength, the concrete in question shall be removed and replaced without cost to the Owner. Any other work damaged as a result of this concrete removal shall be replaced with new materials to the satisfaction of the Engineer at no additional cost to the Owner. The cost of coring will be deducted from the contract amount. Where the Testing Laboratory has taken core cylinders and the concrete proves to be satisfactory, core holes shall be filled in a manner satisfactory to the Engineer at no additional cost to the Owner.
5. The Contractor shall coordinate the date and location of tests with the Engineer before any concrete work is started.

1.05 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Reinforcing steel.

1. Transport to the site, store, and cover in a manner which will ensure that no damage shall occur to it from moisture, dirt, grease, or any other cause that might impair bond to concrete or chip protective epoxy coating.
2. Store on the site at all times, a supply of approved reinforcing steel to ensure that there will be no delay of the work.
3. Identification of steel shall be maintained after bundles are broken.

PART 2 PRODUCTS

2.01 MATERIALS

A. Portland Cement.

1. In accordance with ASTM C150, Type II of U.S. manufacture.
2. Only one brand of cement shall be used on the project.

B. Aggregates.

1. Fine aggregate, in accordance with ASTM C33, clean and graded from 1/4 inch to fines.
2. Coarse aggregate, in accordance with ASTM C33, clean and graded from 1/4 inch to maximum sizes hereinafter specified.

C. Air Entraining Agent.

1. In accordance with ASTM C260.

D. Water Reducing Agent.

1. In accordance with ASTM C494 Type A.

E. Microsilica Admixture.

1. Packaged in easily dispersing form.

F. Water.

1. Clean and potable,
2. Free of impurities detrimental to concrete.

G. Reinforcing Bars.

1. New, deformed billet steel bars, in accordance with ASTM A615, Grade 60.

H. Welded Wire Fabric

1. In accordance with ASTM A185.

I. Accessories.

1. Reinforcement accessories, consisting of spacers, chairs, ties, and similar items shall be provided as required for spacing, assembling, and supporting reinforcement in place.
2. All accessories shall be dielectric coated steel or approved plastic accessories, conforming to the applicable requirements of the CRSI Standards.

J. Tie wire.

1. 16 gauge or heavier black annealed wire.

K. Form Ties and Spreaders.

1. Standard metal form clamp assemble and plastic cone, of type acting as spreaders and leaving no metal within 1 inch of concrete face.

2. Provide form tie with water stop for all walls to be in contact with earth or liquid.
3. Inner tie rod shall be left in concrete when forms are removed.
4. No wire ties or wood spreaders will be permitted. Use ½" x 1" C.T. plastic cones for sinkages.

L. Form Coatings.

1. Non-grain raising and non-staining type that will not leave residual matter on surface of concrete or adversely affect proper bonding of subsequent application of other material applied to concrete surface.
2. "Nox-Crete Form Coating" as manufactured by Nox-Crete Company, or approved equal.
3. Coatings containing mineral oils or the non-drying ingredients will not be permitted.

M. Grout.

1. High-strength, non-shrink grout with saltwater resistance.
2. Five Star Special Grout 120 or equivalent.

2.02 CONCRETE STRENGTHS AND PROPORTIONS

A. Cast-in-place concrete shall have the minimum compressive strength at 28 days as indicated on the Drawings.

B. The exact proportions for the mix, including amounts admixture (if any), and water, shall be determined by the concrete supplier.

C. The proportions of aggregate to cement for any concrete shall be such as to produce a mixture which will work readily into the corners and angles of the forms and around reinforcement with the method of placing employed not he work, but without permitting the materials to segregate or excess free water to collect on the surface.

D. Air-Entrainment: The air content in all concrete shall be maintained at 5 to 7 percent.

2.03 PREMOLDED JOINT FILLER

A. Bituminous Type.

1. In accordance with ASTM D994 or D1751.

B. Sponge Rubber Type.

1. Neoprene, closed-cell, expanded in accordance with ASTM D1056, Type 2C5, with a compression deflection, 25 percent deflection (limits), 17 to 24 psi (119 to 168 kPa) minimum.

2.04 POURABLE JOINT FILLERS

A. Filler for Nonpotable Water Structures

1. Specific Gravity: Greater than 1.0 for cured, in-place filler.
2. Vertical and Sloped Joints: Furnish gun grade material that will remain as placed in joints and will not run down slope.
3. Suitable for continuous immersion and exposure to liquid being contained in the structure.

2.05 JOINT SEALANTS

A. In slabs.

1. In accordance with ASTM C920 for poured 2-component polyurethane sealant.
2. Sikaflex-2c, as manufactured by Sika Corporation or approved equivalent.

B. In walls.

1. Type II, Class A, compound conforming to Interim Federal Specification TT-S-00227E (3) (COM-NBS) for Sealing Compound; Elastomeric Type, Multi-Component (for Caulking, Sealing, and Glazing in Buildings and Other Structures).
2. Sikaflex-1a, as manufactured by Sika Corporation or approved equivalent.

2.06 EPOXY BONDING COMPOUND

A. The epoxy bonding compound shall be a three-component, solvent-free, moisture-tolerant, epoxy modified, cementitious product specifically formulated as a bonding agent and anti-corrosion coating. The product shall have suitable contact time, fluidity, and application temperature for this type of application.

PART 3 EXECUTION

3.01 FORMWORK

A. Falsework for Forms

1. Build and maintain necessary false work for the forms.

B. Construction of Forms

1. General
   a. Construct in accordance with ACI 347.
   b. Construct of sound material, to the correct shape and dimensions, mortar tight, of sufficient strength, and so braced and tied together that the movement of men, equipment, materials, or placing and vibrating the concrete will not throw them out of line or position.
2. Embedded Items
   a. Make provisions for pipes, sleeves, anchors, inserts, reglets, anchor slots, nailers, water stops, and other features.
   b. Do not embed wood, other than necessary nailing blocks, in concrete.
   c. Extended complete cooperation to suppliers of embedded items in their installation.
   d. Secure information for embedded items from other trades as required.
   e. Securely anchored embedded items in correct location and alignment prior to placing concrete.
3. Openings for Items Passing Through Concrete
   a. Establish exact locations, sizes, and other conditions required for openings and attachment of work specified under other sections.
   b. Coordination work of this nature in order that there will be no unnecessary cutting and patching of concrete.
   c. Cutting and repairing of concrete as a result of failure to provide for such openings shall be paid for by the Contractor at no additional expense to the Owner.

C. Removing Forms and False work

1. Forms shall not be removed for at least 72 hours after concrete has been placed.
2. Forms shall not be removed until the concrete has attained sufficient strength to insure stability.

3.02 REINFORCING STEEL

A. General

1. Place reinforcing steel in accordance with the drawings and approved shop drawings and the applicable requirements of the CRSI, Manual of Practice.
2. Install reinforcement accurately and secure against movement, particularly under the weight of workmen and the placement of concrete.

B. Reinforcing Steel Supports

1. Support bars on approved plastic or dielectric-coated metal chairs or spacers, accurately placed and securely fastened to forms or steel reinforcement in place.
2. Supply additional bars, whether specifically shown on the drawings or not, where necessary to securely fasten reinforcement in place.
3. Support legs of accessories in forms without embedding in form surface.
4. Spacing of chairs and accessories shall conform to CRSI, Manual of Standard Practice. Accurately space hoops and stirrups and wire to the reinforcement.
5. Permit no lose wood inside forms.
6. Lifting of welded wire fabric into proper position while concrete is being poured rather than supporting fabric on chairs will not be permitted.

C. Placing and Tying

1. Set in place, space, and rigidly and securely tie or wire with tie wire at all splices and at all crossing points and intersections in the positions shown, or as directed.
2. Rebending of bars on the job to accommodate the job to accommodate existing conditions will not be permitted without the written approval of the Engineer
3. Points ends of wire ties away from forms.

D. Spacing

1. Minimum center to center distance between parallel bars shall be in accordance with the details on the drawings, or, where not shown, the clear spacing shall be 2 times the bar diameter but in no case less than 1½ inches or less than 1½ times the maximum size aggregate.

E. Splices

1. Maximum 50% of steel spliced occurring within lap length.
2. Top bars shall be 1.3 times values given in 3.01.D.5.c.
3. Splice lengths.
   a. #6 bars and smaller: 50-bar diameter
   b. #7 bars and larger: 60-bar diameter

F. Concrete Covering

1. In accordance with ACI 315, except where shown otherwise on drawings.

3.03 CONCRETE

A. Mixing of Concrete

1. All concrete shall be ready-mixed concrete, and shall be mixed and delivered in accordance with ASTM C 94. The batch plant of the concrete producer shall be certified for compliance with the standards established by the National Ready-Mixed Concrete Association.
2. In the event concrete is mixed at a central batching plant, the delivery shall be arranged so that intervals between batches are kept to a minimum, and in any event not more than thirty (30) minutes. Trucks shall be in first class condition and kept in constant rotation during delivery.
3. Concrete shall be placed within 90 minutes after cement has been mixed with aggregate or 45 minutes after addition of water and admixtures.
4. No admixtures, except those mentioned in paragraph 2.1 shall be used. Calcium chloride will not be permitted.
5. Truck delivery slips of all concrete delivered to the job shall indicate the quantity and quality of concrete, additives, date and time of batching and delivery, and the location of placement. Delivery slips shall be forwarded to the Engineer at the end of each pour.

B. Cold Weather Concreting.

1. In accordance with ACI 306.
2. Concrete shall not be mixed or placed when the temperature is below 40 degrees F, or when conditions indicate that the temperature will fall below 40 degrees F within 72 hours unless precautions are taken to protect the concrete.
3. Concrete temperature shall be maintained, when deposited, at not less than 60 degrees F. Reinforcement, forms, and ground which concrete will contact must be completely free of frost.
4. Concrete and formwork must be kept at a temperature of not less than 50 degrees F. for not less than 96 hours after placing.
5. Calcium chloride shall not be used.

C. Hot Weather Concreting.

1. In accordance with ACI 305.
2. The maximum temperature of the concrete, when deposited, shall be 85 degrees F. If the weather causes the placing temperature to exceed 85 degrees F., the mix shall be cooled by methods approved by the Engineer.
3. No concrete shall be deposited when the air temperature is greater than 90 degrees F.

D. Conveying and Placing Concrete.

1. In accordance with ACI 304.
2. Notification: Before placing concrete, forms shall be thoroughly inspected. All chips, dirt, etc., shall be removed, all temporary bracing and cleats taken out, all openings for pipes, etc., properly boxed, all forms properly secured in their correct position and made tight, all reinforcement, anchors, and embedded items secured in their proper places. Concrete which may be on the forms or reinforcement, and which is set and dry, shall be cleaned off, and the forms and steel washed off before proceeding. Remove all foreign matter from forms and excavations.
3. Water shall be removed from place of deposit before concrete is placed unless otherwise permitted by the Engineer. Any flow of water into an excavation shall be diverted through proper side drains into a sump, or shall be removed by other approved methods which will avoid washing away the freshly deposited concrete.
4. Soil on which concrete will be poured shall be thoroughly wetted (except in freezing weather).

5. Anchors and Embedded Items: Anchors, bolts, sleeves, inserts, wood blocking, and any other items to be embedded in concrete shall be accurately secured in position before the concrete is placed. Aluminum shall not be embedded in concrete.

E. Handling and Depositing

a. Before any concrete is placed, notify all whose work is in any way connected with or influenced by the concrete work, and give them reasonable time to complete all portions of their work that must be completed before concrete is deposited.
b. Immediately before concrete is placed, inspect all forms to ensure that they are in proper position, sufficiently rigid, thoroughly clean, properly oiled and free from foreign materials, and that all reinforcement is in proper position.
c. Concreting, once started, shall be carried on as a continuous operation until the section of approved size and shape is completed.
d. Concrete shall be conveyed as rapidly as practicable from the mixer to the place of final deposit by methods that prevent the separation or loss of ingredients. It shall be deposited, as nearly as practicable, in its final position to avoid rehandling or flowing.
e. Concrete shall not be dropped freely where reinforcement will cause segregation, nor shall it be dropped freely more than six (6) feet. Concrete shall be deposited to maintain a plastic surface approximately horizontal.
f. Concrete that has partially hardened shall not be deposited in the work.

F. Pumping

a. Concrete may be placed by pumping if first approved in writing by the Engineer for the location proposed.
b. Equipment for pumping shall be of such size and design as to ensure a practically continuous flow of concrete at the delivery end without separation of materials.
c. The concrete mix shall be designed to the same requirements as herein before specified, and may be richer in lubricating components in order to allow proper pumping.
d. Concrete shall not be pumped through aluminum pipes.

G. Vibrating and Compacting

a. All concrete shall be thoroughly consolidated and compacted by suitable means during the operation of placing, and shall be thoroughly worked around reinforcement, embedded items, and into the corners of the forms. All concrete against forms shall be thoroughly spaded. Internal vibrators shall be used under experienced supervision, and shall be kept out of contact with reinforcement and wood forms. Vibrators shall not be used in a manner that forces mortar between individual form members.
b. Vibrators shall be flexible electric type or approved compressed air type, adequately powered and capable of transmitting to the concrete not less than seven thousand (7,000) impulses per minute. Vibration shall be sufficiently intense to cause the concrete to flow or settle readily into place without separation of the ingredients. A sufficient number of vibrators shall be employed so that complete compaction is secured throughout the entire volume of each layer of concrete. At least one (1) vibrator shall be kept in readiness as a spare for emergency use. Vibrators shall be such that the concrete becomes uniformly plastic with their use.
c. Vibration shall be close to the forms but shall not be continued at one spot to the extent that large areas of grout are formed or the heavier aggregates are caused to settle. Care shall be taken to not disturb concrete that has its initial set.

d. Where conditions make compacting difficult, or where the reinforcement is congested, batches of mortar containing the same proportions of cement to sand as used in the concrete shall first be deposited in the forms, to a depth of at least on inch.
e. The responsibility for providing fully filled out, smooth, clean, and properly aligned surfaces free from objectionable pockets shall rest entirely with the Contractor.

3.04 CONSTRUCTION JOINTS

A. Construction joints shall be located a maximum of 40 feet apart. If, for any reason, the contractor feels a change is necessary, he shall prepare a placing plan and submit it to the Engineer for approval.

B. Where a joint is to be made, the surface of the concrete shall be sandblasted or thoroughly picked, thoroughly cleaned, and all laitance removed. In addition to the foregoing, joints shall be thoroughly wetted, but not saturated, and slushed with a coat of grout immediately before the placing of new concrete.

C. Approved keys shall be used at all joints, unless detailed otherwise.

D. Forms shall be retightened before placing of concrete is continued. There shall be an interval of at least 48 hours between adjacent pours.

E. Bonding Concrete at Construction Joints

1. To new concrete construction joints:
   a. Thoroughly clean and saturate joint with water.
   b. Cover horizontal wall surfaces as specified in this Section, and immediately place concrete.
   c. Limit concrete lift placed immediately on top of bonding compound to 12 inches thick.
   d. Thoroughly vibrate to mix and consolidate bonding compound and concrete together.

3.05 BONDING NEW CONCRETE TO OLD CONCRETE:

1. Mechanically roughen existing concrete surfaces to a clean, rough surface using appropriate mechanical means to remove the existing concrete surface, and provide a minimum roughness profile of ¼-inch.
2. Saturate surface with water for 24 hours, cover with epoxy bonding compound and place concrete as specified for new concrete.

3.06 EXPANSION JOINTS

1. Expansion joints shall be located as shown on contract drawings.
2. The joint shall include a joint filler, a bond breaker and joint sealant and installed as indicated on contract drawings.

3.07 JOINT SEALANTS.

1. Prepare surface in accordance with manufacturers directions.
2. Apply primer as recommended by sealant manufacturer.
3. Install sealant with the proper tools and methods as directed by the sealant manufacturer.

3.08 PATCHING

1. Immediately after stripping forms, patch minor defects, form-tie holes, honeycombed areas, etc., before concrete is thoroughly dry.
2. Repair gravel pockets by cutting out to solid surface, form key, and thoroughly wet before placing patching mortar consisting of 1 part cement to 2 parts fine sand; compact into place and neatly finish. Honeycombed areas or gravel pockets which, in the Engineer's opinion are too large and unsatisfactory for mortar patching as described above, shall be cut out to solid surface, keyed, and packed solids with matching concrete to produce firm bond and surface.
3. The Contractor shall do all the cutting as required by himself or other trades. All such work shall be of the minimum size required. No excessive cutting will be permitted, or shall any structural members or reinforcement be cut.
4. The Contractor shall do all patching after work by other trades has been installed, where required, using Portland Cement Mortar 1:2 mix.

3.09 PROTECTION AND CURING

1. Protect concrete from injurious action of the elements and defacement of any nature during construction operations.
2. Keep concrete in a thoroughly moist condition from the time it is placed until it has cured, for at least (7) days.
3. Carefully protect exposed concrete corners from damage.
4. Allow no slabs to become dry at any time until curing operations are complete. In general, slabs shall be cured with non-staining curing paper, hosing or fog spray; vertical surfaces shall be curing with Burlene or fog spray or an approved curing compound.
5. Protect fresh concrete from drying winds, rain, damage, or spoiling. Curing paper shall be lapped 4 inches minimum at joints and sealed with waterproof tape.

3.10 CONCRETE FINISHES

1. Unexposed Surfaces: All unexposed surfaces shall have any form finish, at the Contractor's option.
2. Wearing Surface Finish: Float the surface by hand using a wooden or magnesium float. Finish with a flexible bristle broom. Permit surface to harden sufficiently to retain the scoring or ridges. Broom transverse to traffic or at right angles to the slope of the slab.
3. Addition of Material: The addition of cement, sand, water, or mortar to slab surfaces while finishing concrete is strictly prohibited.

3.11 DEFECTIVE WORK

1. The following concrete work shall be considered defective and may be ordered by the Engineer to be removed and replaced at Contractor's expense:
    a. Incorrectly formed.
    b. Not plumb or level.
    c. Not specified strength.
    d. Containing rock pockets, voids, honeycomb, or cold joints.
    e. Containing wood or foreign matter.
    f. Otherwise not in accordance with the intent of the Drawings and Specifications.

END OF SECTION

SECTION 03400

PRECAST ARCHITECTURAL CONCRETE

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Precast concrete roof curbs and window sills.

2. Reinforcement, anchors, and accessories.

B. Related Work: The following items are not included in this Section and are specified under the designated Sections:

1. Section 04210 – ARCHITECTURAL FACE BRICK.

2. Section 04220 – REINFORCED UNIT MASONRY.

3. Section 05500 – METAL FABRICATIONS.

4. Section 06100 – ROUGH CARPENTRY.

5. Section 07620 – SHEET METAL FLASHING AND TRIM

6. Section 07920 – JOINT SEALANTS.

1.2 REFERENCES

A. ASTM C1364-18 – Standard Specification for Architectural Cast Stone.

1.3 SUBMITTALS

A. Submit under provisions of Section 01300 - Administrative Requirements.

B. Selection Samples: For each product specified, a range of color and texture samples from which the final can be selected. Samples to be from the range of manufacturers standard colors and textures.

C. Verification Samples: Mock-up samples shall serve as verification samples, to be reviewed in the field.

D. Manufacturer's Certificates: Certify products meet or exceed specified requirements.

1.4 MOCKUP

A. Provide two architectural precast samples to serve as mock-up for review and approval.

B. Install the two precast mock-up blocks on the assembled (masonry and brick) mockup using the appropriate fasteners, grout and sealants, and flashings and tooling, and cleaning as specified, and as shown on the Drawing. Samples to be installed adjacent to one another, to

illustrate the joint between and fastening and proposed installation method. Size and shape of samples as noted on the drawings.

C. The approved sample panel shall be a standard of workmanship for the Work and if accepted, incorporated into project.

D. Mockup panel shall not be removed until masonry work required by this Section has been completed and accepted.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle materials to prevent inclusion of foreign materials and damage by water or weather. Store packaged materials in their original packages. Remove damaged or deteriorated materials from the premises

1.6 PROJECT CONDITIONS

A. Follow hot weather and cold weather requirements in the masonry code and specifications, TMS 402 and TMS 602.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers
   1. Shea Concrete, sheaconcrete.com Wilmington, MA, Phone: 978-658-2645.
   2. Precast Specialties Corp. https://www.precastspecialtiescorp.com/ Abington, MA 02351. Phone: 781-878-7220.
   3. Patriot Precast, formerly MGA Cast Stone, 7 Oxford Homes Lane, Oxford, ME. Tel. 207-539-6035. patriotprecast.com .

B. Requests for substitutions will be considered in accordance with provisions of Section 01600 – PRODUCT REQUIREMENTS.

2.2 PRECAST UNITS

A. Custom Roof Parapet Curbs:
   1. Special shape roof parapet curbs shall be as detailed and at locations as indicated on the Drawings.
      a. Color: Gray, to be confirmed with sample
      b. Texture: TBD

B. Special Shape Window sills:
   1. Special shape window sills shall be as detailed and at locations as indicated on the Drawings.
      a. Color: Same as Parapets
      b. Texture: Same as Parapets

2.3 ANCHORS AND TIES

A. Acceptable Manufacturers:
   1. Products of Hohmann and Barnard and Heckman Building Products, conforming to specification requirements are acceptable.

B. Requests for substitutions will be considered in accordance with provisions of Section 01600 – PRODUCT REQUIREMENTS.

C. Anchors: As required by manufacturer and for code compliance.

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not begin installation until backup substrates have been properly prepared.

B. Verify field conditions are acceptable and are ready to receive work.

C. Verify built-in items are in proper location, and ready for roughing into masonry work.

D. If backup substrate and other preparation work is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Furnish temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent support.

3.3 INSTALLATION

A. Heat water and sand in cold weather. Do not set precast forms in temperature below freezing unless such heating of materials and protection of work is properly provided for.

B. Set precast forms true to dimensions, plumb, and square. All courses shall be level with joints of uniform width and height.

C. Vertical joints in facing bond work shall be spaced so as to line up plumb and true, and all joints shall be as uniform as the type of brick will allow.

D. Anchor curbs to masonry backup at 16 inches o.c. vertically and 16 inches o.c. horizontally with adjustable anchors and ties.

E. Joint thickness shall be such as to provide coursing pattern to match existing brickwork. When the joints have become thumbprint hard, all exposed joints shall be tooled with a sled-jointing tool. The jointer shall be larger than the width of the joints so that a complete contact is made along the edges of the units, compressing and sealing the surface of the joint. Joints shall be pointed as the tool proceeds.

F. Where fresh masonry joins masonry that is partially set or totally set, the exposed surface of the set masonry shall be cleaned and lightly wetted so as to obtain the best possible bond with the new work. All loose brick and mortar shall be removed.

3.4 FLASHING

A. Build in, as the work progresses all flashings which enter the masonry as specified in Sections 07620 SHEET METAL FLASHING AND TRIM.

B. Extend all flexible flashing 1 inch past face of wall and trim after tooling joints.

C. Where metal flashing or drip edge is shown, align drip with face of brick. Edge of flashing or drip edge shall be a simple hem rolled edge and not turned down.

3.5 OPENINGS AND HOLES

A. Provide all chases and recesses in masonry work of all types as indicated on the Drawings and as required for pipes, ducts, and other work of Mechanical and Electrical trades. Such work shall be accurately located by the trades requiring the work, but masonry work shall not be constructed without giving other trades due notices and opportunity to lay out or install such items as may be required for their work.

B. Where required for installation of work of other trades, leave openings as indicated on the Drawing or as required to receive a later installation.

C. After work of other trades is in place, openings shall be neatly filled with masonry of the same type as in the adjoining surfaces.

3.6 SETTING AND BUILDING-IN

A. Build-in materials occurring in any type of masonry construction that are furnished by other trades. All built-in work shall be accurately placed, secured, held in position, and located by the trade requiring the work.

B. Set and built -in items of related miscellaneous iron such as loose lintels and anchors required to complete all parts not connected to building framing.

C. Set all anchor bolts required for the attachment of work to masonry.

D. Build-in recesses, flashings, receivers, slots, anchors, sleeves and other work shown on Drawings.

E. The curb shall be set such that the front top arris line conforms to the required line and elevation.

F. Curb sections shall be placed end-to-end as close as possible. No more than ½" opening shall show for the full width of the top and the front.

G. All gaps between all curb sections shall be filled with grout and neatly troweled.

3.7 CLEANING

A. After tooling and pointing is done, clean face brick surface with dry brush.

B. After 3 days clean with water and mild detergent or cleaners recommended by precast concrete manufacturer. Do not use muriatic acid.
   1. Wet precast surfaces thoroughly before applying cleaning solution.
   2. Apply cleaning solution with bucket and brush or low pressure spray.
   3. Remove all stains and mortar streaks using stiff fiber bristle brush.
   4. Rinse thoroughly with water.
   5. Protect windows, landscaping, and surrounding masonry surfaces from cleaning solution and rinse water.

END OF SECTION

SECTION 03930

CONCRETE REHABILITATION

PART 1 GENERAL

1.01 RELATED WORK SPECIFIED ELSEWHERE

A. Crack Repairs by Epoxy Injection: Section 03940.

1.02 REFERENCES

A. Except as shown or specified, the Work of this Section shall conform to the requirements of International Concrete Repair Institute (ICRI), 3166 S. River Rd., Suite 132, Des Plaines, IL 60018, (847) 827-0830, www.icri.org.
   1. ICRI Guideline No. 310.1R-2008 Guide for Surface Preparation for the Repair of Deteriorated Concrete Resulting from Reinforcing Steel Corrosion (formerly Guideline No. 03730).

1.03 SUBMITTALS

A. Product Data: Manufacturer's specifications and installation instructions for factory packaged products.

1.04 QUALITY ASSURANCE

A. Field Examples: Prior to performing the Work of this Section, prepare a sample panel, or a portion of existing concrete which is to be repaired, to represent each type of rehabilitation work required. Approved samples will be used as quality standards for the Work. Maintain approved samples at the site until the Work is completed.

B. Material Container Labels: Material containers shall bear the manufacturer's label indicating manufacturer's name, trade name of product, lot number, shelf life of product, and mix ratio (if applicable).

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to the site in original, sealed containers. Do not deliver materials that have exceeded shelf life limitation set forth by the manufacturer.

B. Comply with manufacturer's printed instructions for storing and handling materials.

1.06 PROJECT CONDITIONS

A. Environmental Requirements: Comply with the product manufacturer's printed limitations and instructions.

PART 2 PRODUCTS

2.01 COMPANIES

A. The Euclid Chemical Company, 19218 Redwood Rd., Cleveland, OH 44110-2799, (800) 321-7628, www.euclidchemical.com.

B. Sika Corporation, 201 Polito Ave., Lyndhurst, NJ 07071, (800) 933-7452, www.sikausa.com.

C. Kaufman Products, Inc., 3811 Curtis Ave., Baltimore, MD 21226, (800) 637-6372, www.kaufmanproducts.net.

D. L&M Construction Chemicals, Inc., 14851 Calhoun Rd., Omaha, NE 68152, (800) 362-3331, www.lmcc.com.

E. Conproco Corp., 17 Production Dr., Dover, NH 03820, (800) 258-3500, www.conproco.com.

F. BASF Building Systems, 889 Valley Park Dr., Shakopee, MN 55379, (800) 433-9517, www.buildingsystems.basf.com.

2.02 MATERIALS

A. The following brand names are specified to establish product generic type and standard of quality. Other comparable products in the manufacturer's same product series may be required to closely fit the particular job conditions. Use appropriate product for depth of patch and temperature at time of application. More than one product may be required for a particular type of patching mortar. When a color choice is available, select the color to match adjoining concrete as closely as practicable. A bonding agent/primer and/or sealer shall be used as recommended by the patching mortar manufacturer.

B. Cement/Acrylic/Latex Base Patching Mortars:

1. Type C-2 Patching Mortar: "SikaTop 121 Plus", "SikaTop 122 Plus" or "SikaTop 111 Plus" by Sika Corp.; "Patchwell Kit", "Patchwell Deep", "SureFlow 040", or "SureFlow 042" by Kaufman Products, Inc.; "Thincoat" or "Concrete Coat" by The Euclid Chemical Company;

2. Type E-3 Patching Mortar: High modulus, medium/low viscosity, moisture insensitive, epoxy resin and aggregate system; "Sikadur 35" or "Sikadur 52" by Sika Corporation, "Duralcrete" by The Euclid Chemical Company or "SurePoxy HM", "SurePoxy HM, Class B", "SurePoxy HMLV", "SurePoxy HMLV, Class B", "SurePoxy HMSLV", "SurePoxy HiBild" by Kaufman Products, Inc.

C. Rebar Coating: "SurePoxy HMEPL" or SurePoxy HM 12" by Kaufman Products, Inc.; "ECB" by Conproco Corp.; or "MasterEmaco P122" or "MasterEmaco P124" by BASF Building Systems.

D. Cleaning Agent, Bonding Agent/Primer, Sealer/Topcoat: As recommended by the patching mortar manufacturer, including primer for the reinforcing steel and primer for the concrete substrate.

E. Concrete and Bonding Agent (for concrete): Normal weight cast-in-place concrete and adhesive bonding agent as specified in Section 03300.

PART 3 EXECUTION

3.01 PREPARATION

A. Protection: Cover or otherwise protect adjacent surfaces not being repaired.

B. Surface Preparation:
1. Prepare surfaces to be repaired in accordance with the product manufacturer's printed instructions and as specified.
2. Cut out and remove cracked, spalled, and disintegrated concrete. Cut back to sound concrete. Cut edges of patch perpendicular to surface of patch, unless otherwise recommended by mortar manufacturer. If steel reinforcing bars are exposed, chip concrete out from behind exposed length of bars as required for a minimum clearance around circumference of bar of 3/4 inch. In addition, cut a minimum one inch length of sound concrete away from each end of exposed length of reinforcing bars.
3. Clean exposed steel reinforcement by oil-free abrasive blasting or high-pressure water blasting; remove bits of concrete and loose rust. If reinforcement is bowed out toward surface of the concrete, bend reinforcement back from surface.
4. Remove paint, oils, grease, dirt, salt deposits, laitance and other contaminants from surfaces to be patched. Use cleaning agent where required.
5. Clean areas to be patched with oil-free air or water under pressure, except as otherwise recommended by the mortar manufacturer.

3.02 COATING REBAR

A. Coat reinforcing as soon as possible after completion of surface preparation.

B. Place reinforcement coating complying with manufacturers printed instructions.

3.03 PATCHING CONCRETE

A. Patch concrete as soon as possible after completion of surface preparation.

B. Mixing Patching Mortar: Comply with mortar manufacturer's printed instructions. Proportion components and sizes of aggregate as recommended by mortar manufacturer for the particular job conditions.

C. Patch concrete in accordance with the product manufacturer's printed instructions.
1. Coat contact surfaces of existing concrete and steel reinforcing with a bonding agent/primer as recommended in the product manufacturer's instructions.

D. Bring patches out to the original surfaces in true planes. Finish patches to match texture of adjoining concrete as close as possible.

E. Cure patches in accordance with the product manufacturer's printed instructions.

3.04 CLEANING

A. Clean up spatters and droppings.

3.05 PROTECTION

A. Protect mortar after placement in accordance with the product manufacturer's printed instructions.

END OF SECTION

SECTION 03940

CRACK REPAIRS BY EPOXY INJECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Structural repair of cracks in concrete by permanently rebonding the concrete with epoxy resin adhesive injected under pressure with special equipment.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Concrete Rehabilitation: Section 03930.

1.03 PERFORMANCE REQUIREMENTS

A. Seepage of water through cracks repaired under the Work of this Section will be regarded as defective Work subject to the one year guarantee required by the General Conditions.

1.04 SUBMITTALS

A. Product Data: Manufacturer's printed specifications and installation instructions for epoxy adhesive and surface seal material.

B. Quality Control Submittals:
   1. Test Reports:
      a. Submit reports for tests specified under Source Quality Control.
      b. If requested, submit test reports for all specified characteristics and properties of the epoxy adhesive materials from an Independent Testing Laboratory.
   2. Certificates: Affidavit required under QUALITY ASSURANCE Article.
   3. Installation Contractor's Qualifications Data:
      a. Firm name, address, and telephone number.
      b. Period of time firm has performed crack repairs by epoxy injection.
   4. Installer's Qualifications Data:
      a. Name of each person who will be performing the Work and their employer's name, business address and telephone number.
      b. Period of time installer has performed crack repairs by epoxy injection.
      c. Proof of satisfactory completion of a program of instruction in the epoxy injection process.

1.05 QUALITY ASSURANCE

A. Qualifications:
   1. Installation Contractor: The firm performing the Work of this Section shall have been regularly engaged in crack repairs by epoxy injection for a minimum of 5 years, shall be licensed or approved by the epoxy adhesive manufacturer to perform such work, and shall have completed 5 similar projects in the last 5 years.

2. Installer: The person(s) performing the Work of this Section and their Supervisor shall be personally experienced in crack repair by epoxy injection and shall have been regularly employed by a Company performing crack repair by epoxy injection for a minimum of 2 years, and shall have satisfactorily completed a program of instruction in the epoxy injection process.
    a. The instruction shall include this specific method of repairing cracks in concrete, the technical aspects of correct material use, and the operation, maintenance and checking of equipment.

B. Testing Agency: Tests for all specified characteristics and properties of the epoxy adhesive materials shall have been performed by a qualified Independent Testing Laboratory and copies of the test results shall be available. Tests indicated under Source Quality Control shall be performed by the adhesive manufacturer.

C. Source Quality Control: The following quality control tests shall be performed on each lot of epoxy adhesive materials supplied for this Project. Tests shall be conducted using the test methods indicated in Part 2.
1. Resin viscosity at 77 degrees F and epoxide equivalent weight.
2. Hardener viscosity at 77 degrees F and amine value.
3. Combined components pot life at 77 degrees F.
4. Cured (for 7 days) adhesive ultimate tensile strength and tensile elongation at break; and slant shear strength for wet/wet concrete cured 3 days.

D. Material Container Labels: Material containers shall bear a manufacturer's label indicating manufacturer's name, trade name of product, lot number, shelf life of product, and mix ratio by volume.

E. Equipment for Injection: The injection equipment shall meter and mix the adhesive components, and inject the mixed adhesive into the cracks. Equipment shall be a portable, positive displacement type pump unit with interlock to insure exact ratio control of the two components at the nozzle. Unit shall have metering pumps, electrically or air powered, which will provide in-line metering and mixing of the adhesive components.
1. Discharge Pressure: The injection equipment shall have automatic pressure control capable of discharging the mixed adhesive at any pre-set pressure up to 200 psi (within a tolerance of plus or minus 5 psi), and shall be equipped with a manual pressure control override.
2. Ratio Tolerance: The injection equipment shall have the capability of maintaining the volume ratio for the adhesive, as prescribed by the manufacturer of the adhesive, within a tolerance of plus or minus 5 percent by volume at any discharge pressure up to 200 psi.
3. Automatic Shut-Off Control: The injection equipment shall have sensors on both component reservoirs that will automatically stop the machine when only one component is being pumped to the mixing head.

F. Certificates: Affidavit from the epoxy adhesive manufacturer certifying that each batch of epoxy adhesive material shipped for this Project complies with the requirements of these specifications.

1.06 DELIVERY AND STORAGE

A. Deliver materials to the site in original, sealed containers bearing manufacturer's label. Do not deliver materials which have exceeded shelf life limitation set forth by the manufacturer.

B. Comply with manufacturer's printed instructions for storing materials in original, sealed containers at a temperature between 32 degrees F and 90 degrees F.

1.07 PROJECT CONDITIONS

A. Environmental Requirements: Comply with manufacturer's recommendations for conditions under which materials can be applied.

PART 2 PRODUCTS

2.01 MATERIALS

A. Epoxy Adhesive: Two component, low viscosity, epoxy resin adhesive system containing 100 percent solids, with no solvents or non-reactive diluents, which meets the following characteristics and properties:
   1. Resin: Blend of epoxy resins.
      a. Viscosity at 40 + 3 degrees F, cps (Brookfield RVT Spindle No. 4 at 20 rpm): 6,000 - 8,000.
      b. Viscosity at 77 + 3 degrees F, cps (Brookfield RVT Spindle No. 2 at 20 rpm): 300 - 700.
      c. Epoxide Equivalent Weight (ASTM D 1652): 160 - 220.
      d. Ash Content, percent (ASTM D 482): 1 maximum.
   2. Hardener: Blend of amine curing agents.
      a. Viscosity at 40 + 3 degrees F, cps (Brookfield RVT Spindle No. 2 at 20 rpm): 700 - 1,400.
      b. Viscosity at 77 + 3 degrees F, cps (Brookfield RVT Spindle No. 2 at 20 rpm): 100 - 400.
      c. Amine Value, mg K0H/g (ASTM D 664): 490 - 560.
      d. Ash Content, percent (ASTM D 482): 1 maximum.
   3. Pot Life of the Combined Components: When mixed in the ratio recommended by the manufacturer for use, material shall have pot life as follows:
      a. 60 g at 77 + 3 degrees F: 13 - 55 minutes.
   4. Properties of the Cured Adhesive: When cured for 7 days at 77 + 3 degrees F, material shall have the following properties:
      a. Ultimate Tensile Strength, psi (ASTM D 638): 5,000 minimum.
      b. Tensile Elongation at Break, percent (ASTM D 638): 4 maximum.
      c. Flexural Strength, psi (ASTM D 790): 10,000 minimum.
      d. Compressive Yield Strength, psi (ASTM D 695): 10,000 minimum.
      e. Slant Shear Strength, psi (AASHTO T 237, 5,000 psi compressive strength concrete):
         1) Cured 3 days at 40 + 3 degrees F, wet/wet concrete: 3,500 minimum.
         2) Cured 7 days at 40 + 3 degrees F, wet/wet concrete: 4,000 minimum.
         3) Cured 1 day at 77 + 3 degrees F, dry/dry concrete: 5,000 minimum.

B. Surface Seal: Material with adequate strength and adhesion to hold injection fittings firmly in place and to prevent leakage of epoxy adhesive during injection, and removable without damaging or defacing structure being repaired.

C. Finishing Patching Materials: As required to match color, texture, and performance of adjoining surfaces as closely as practicable.

PART 3 EXECUTION

3.01 PREPARATION

A. Clean cracks and adjacent surfaces free of loose material, dust, dirt, grease, oil, efflorescence, and other foreign matter in accordance with epoxy adhesive manufacturer's printed instructions and as required for proper bonding of surface seal. Do not use acids or corrosives.

B. Establish entry ports along each crack spaced at intervals not less than the thickness of the concrete member being repaired.

C. Apply surface seal material to the face of each crack between the entry ports as required to prevent escape of injected epoxy adhesive. For cracks all the way through the concrete member, apply surface seal to both faces of cracks where accessible. Allow sufficient time for the surface seal material to gain adequate strength before proceeding with epoxy injection.

D. If cracks extend into moving joints, plug or seal off the cracks at the joints.

3.02 EPOXY INJECTION

A. Set up and check injection equipment and material in accordance with the manufacturer's instructions and as specified. Do not thin epoxy adhesive.

B. Beginning at the lowest entry port in the crack, unless otherwise recommended by the installer because of the configuration of the crack, inject epoxy adhesive in the entry port until there is an appearance of adhesive at the next adjacent entry port. When epoxy adhesive travel is indicated at the next adjacent port, discontinue injection in the port, seal off the port, and resume injection in the next adjacent port. Continue this procedure until the crack has been injected full of epoxy adhesive for its entire length in one continuous operation. For horizontal cracks, proceed from one end of the crack to the other end in the same manner. Seal the last port, and allow the adhesive to cure.

C. If port to port travel of epoxy adhesive does not result after a reasonable amount of pumping, stop injecting adhesive. Report abnormal conditions (if any) immediately to the Director's Representative.

3.03 FINISHING

A. Remove surface seal and entry port fittings when epoxy adhesive has sufficiently cured to allow removal without disturbing the adhesive.

B. Fill the face of the crack out flush with the concrete surface plane with patching materials. Eliminate indentations and evidence of port fittings. Finish patches to match texture of adjoining concrete surface as closely as practicable.

3.04 FIELD QUALITY CONTROL

A. Furnish equipment necessary to perform field testing.

B. Pressure Test: The mixing head of the injection equipment shall be disconnected and the two supply lines shall be attached to a pressure check device. The pressure check device shall consist of two independently valved nozzles capable of controlling flow rate and pressure by opening or closing the valve. There shall be a pressure gauge capable of sensing the pressure build-up behind each valve. The valves on the pressure check device shall be closed and the injection equipment operated until the gauge pressure on each line reads 190 psi. The pumps shall be stopped and the gauge pressure shall not drop below 180 psi within 3 minutes.

C. Ratio Tests: The mixing head of the injection equipment shall be disconnected and the two adhesive components shall be pumped simultaneously through a ratio check device. The ratio check device shall consist of two independently valved nozzles capable of controlling back pressure by opening or closing the valve. There shall be a pressure gauge capable of sensing the back pressure behind each valve. The discharge pressure shall be adjusted to 180 psi for both adhesive components, and then the components shall be simultaneously discharged into separate calibrated containers. The amounts discharged into the containers during the same time period shall be compared to determine the volumes and the ratio of the components. The test shall be repeated with the discharge pressure adjusted to 0 psi for both adhesive components.

D. Frequency of Pressure and Ratio Tests: A pressure test and ratio tests shall be performed for each injection equipment unit at the beginning of each shift and after the meal break of each shift that the unit is used.
1. Perform additional tests when directed by the Director's Representative.

E. Records of Tests: Record the date and results of all tests, and furnish a copy of the test records to the Director's Representative.

3.05 CLEANING

A. Remove adhesive runs and spills from existing surfaces by a method which will not deface the surfaces being cleaned.

END OF SECTION

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DIVISION 04

SECTION 04200

UNIT MASONRY

GENERAL

1.01 SUMMARY

A. Section Includes

1. Requirements for furnishing all required labor, materials, accessories, tools, apparatus and equipment for the masonry work shown on the Drawings and described in the Specifications.
2. Requirements of this section apply to masonry work specified in Section 02430 – Reinforced Unit Masonry.

B. Related Sections

1. Section 04100 - Mortar and Masonry Grout
2. Section 04230 – Reinforced Unit Masonry
3. Section 05120 – Structural Steel
4. Section 07620 - Flashing and Sheet Metal Work
5. Section 07920 - Sealants

1.02 REFERENCES

A. American Society for Testing Materials (ASTM)

1. A82, Specification for Steel Wire, Plain, for Concrete Reinforcement.
2. A153, Specification for Zinc Coating (Hot Dip) on Iron and Steel Hardware.
3. C90, Specification for Loadbearing Concrete Masonry Units.
4. C55, Specification for Concrete Brick.
5. C216, Specification for Facing Brick (Solid Masonry Units Made from Clay or Shale).
6. C331, Specification for Lightweight Aggregates for Concrete Masonry Units.
7. D226, Specification for Asphalt Saturated Organic Felt Used in Roofing and Waterproofing.
8. D1056, Specification for Flexible Cellular Materials-Sponge or Expanded Rubber.
9. D2287, Specification for Nonrigid Vinyl Chloride Polymer and Copolymer Molding and Extrusion Compounds.

1.03 SUBMITTALS

A. In accordance with Section 01300.

B. Product Data

1. Submit manufacturer's technical data sheets for approval of each of the items in this Section of the specifications.

C. Samples

1. No brick or masonry unit shall be ordered or delivered until the following samples have been approved in writing by the Engineer.
   a. Concrete masonry units, labeled showing the name of the manufacturer.
   b. Face brick, representing the complete range of colors and sizes of brick to be supplied, labeled showing the name of the manufacturer and the kind of brick.
2. Submit samples of all accessories.

1.04 QUALITY ASSURANCE

A. Field Constructed Mock-up

1. Construct prior to installation of masonry work.
2. Panel to represent completed masonry work for qualities of appearance, all materials and methods of construction.
3. Locate mock-up in location indicated on the Drawings, if not indicated as directed by the Engineer.
4. Build a mock-up in size approximately 6 feet long by 4 feet high by full thickness, including all elements of construction for each of the following:
   a. Typical exterior concrete masonry wall.
   b. Typical interior partition of concrete masonry units.

B. Pre-Installation Meeting

1. The Contractor is to coordinate a meeting with the Resident Field Engineer and the Design Engineer to discuss the construction sequencing of the masonry work, reinforcing installation and the placement of the grout.

1.05 DELIVERY, STORAGE AND HANDLING

A. Deliver masonry materials to site undamaged.

B. Store and handle masonry units to prevent their deterioration or damage.

C. Store masonry accessories including metal items to prevent deterioration by corrosion and accumulation of dirt.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Obtain masonry units of similar type to be exposed from one manufacturer for each different product required for each continuous surface or visually related surfaces in order to provide uniform texture and color.

2.02 MATERIALS

A. Mortar

1. In accordance with Section 04100.

B. Face Brick

1. Face brick shall be extruded brick conforming to the applicable requirements of ASTM Designation C216 for Grade SW, Type FBS and shall be "A" quality having a clear face and two clear ends.
2. Face brick shall be modular size, 2-1/4 inches by 7-5/8 inches face by 3-5/8 inches depth except where special brick is noted on drawings.
3. As standard of color and texture only, color and texture shall match the existing brick of adjacent buildings.
4. Brick will be solid, and shall conform in all respects to the requirements of applicable building codes.
5. Lip bricks shall be provided as shown on Drawing.
6. Brick with absorption greater than 8 percent by weight shall not be accepted.

C. Concrete Masonry Units (CMU)

1. Concrete Masonry Units shall conform to the requirements of ASTM Designation C90, hollow units of 8 inches by 16 inches nominal face size and bed dimension as shown on the Drawings. CMU for bearing walls shall be load bearing. CMU shall be of lightweight aggregates conforming to ASTM C331, and having a minimum ultimate compressive strength of 2500 psi in the net cross-sectional area. The weight of each CMU shall not exceed the following:

Bed Dimension	Maximum Weight, lbs/unit
4-in.	20
6-in.	23
8-in.	30
10-in.	38
12-in.	45

2. CMU shall be free from substances that will cause staining or pop-outs and shall have a fine and even texture with straight and true edges. All CMU shall have been wet steam cured for at least 18 hours and then air-cured in covered storage for not less than 28 days before delivery. CMU, when received at the building site, shall be stacked as to provide air circulation and shall be protected from the weather. Moisture content of blocks when laid shall not exceed 35 percent of total absorption. CMU are to be two (2) cell unless otherwise noted.
3. Provide special block required by the Drawings, including, but not necessarily limited to, solid, corner, lintel and jamb units.
4. Finish of CMU shall have exposed surfaces plane and free from noticeable cracks, pits, damaged corners, and other imperfections.

D. Concrete Brick

1. In accordance with ASTM C55.
2. Grade and type to be same as approved CMU.
3. Weight Classification: Normal weight.
4. Size: 3 1/8 inches x 2 ¼ inches x 7 5/8 inches.

E. Sound Block

1. Sound Block shall be the sound absorbing concrete masonry units and shall be manufactured to meet ASTM C90.
2. Units shall be 8 inches x 16 inches nominal face size.
3. Color and pattern shall be selected by the Engineer from the manufacturer's full range of standard colors and patterns.
4. Products shall be as manufactured by:
   a. Trenwyth Industries, Inc.- "Acousta-Wal, Type IVRF"
   b. The Proudfoot Co., Inc.- "Soundblox, Type RSC/RF"
   c. Or approved equal.

2.03 JOINT REINFORCEMENT

A. All masonry walls shall be reinforced as noted on the Drawings.

B. Horizontal joint reinforcement for cavity walls.

1. Reinforcement shall be as indicated on the Structural Drawings.
2. Galvanized in accordance with ASTM A153, Class B-2, 1.5 oz. per sq. ft. of wire surface.
3. Adjustable assembly with the eye sections welded to the truss section at 16-inches on centers. Single wythe and multiple wythe walls shall be ladder type located 8" on center (every block course).

4. Widths approximately two (2) inches less than the nominal width of walls and patricians as required to provide mortar coverage of not less then 5/8 inches on joint faces exposed to the exterior and ½ inch elsewhere or as indicated on the Drawings.
5. Product to be Dur-O-Eye as manufactured by Dur-O-Wall, Inc., or equal.

2.04 VERTICAL REINFORCEMENT

A. In accordance with Section 04230

1. Size and spacing indicated on the Structural Drawings.
2. All vertical reinforcing shall be installed using vertical bar positioners, as manufactured by Dur-O-Wall or equal, for locating the reinforcement in the center of the cells.

2.05 ACCESSORIES

A. Compound masonry anchors shall be equal to "Star Slugin" manufactured by Star Expansion Industries, or equal product manufactured by Rawls, Phillips Drill Company. No less than two anchor units shall be used on any installation. Iron or steel shall be attached to concrete or masonry with steel machine bolts unless specifically noted otherwise. Furnish anchor units complete with bolts and nuts as specified and plate washers where indicated.

B. Anchorage to concrete formwork with Dovetail Slots and Anchors

1. 22 gage hot dip galvanized channel slots, with filler strips.
   a. Bar type anchor, Manufacturers standard hot dip galvanized anchor with dovetail anchor section formed from 16 gage sheet metal, 7/8 inches wide, corrugated, turned up ¼ inch at end.
   b. Wire type anchor, 6 gage wire, triangular shaped.
2. Length shall be as shown on drawings.
3. Manufactured by Dur-O-Wall, Inc. or equal.

C. Anchorage to steel framework

1. Manufactures standard anchors with crimped ¼ inch diameter hot dipped galvanized wire anchor section for welding to steel and 0.187 inch diameter triangular shaped wire tie sections.
2. Length shall be as shown on drawings.
3. Manufactured by Dur-O-Wall, Inc. or equal.

D. Corrugated veneer ties

1. 22 gage, 7/8 inches wide, 6 inches long, galvanized.

E. Rigid anchors for intersecting bearing walls

1. 1 ½ inches wide by ¼ inch thick by minimum 24 inches long.
2. Turn up ends minimum 2 inches or provide cross pins.

F. Flashing

1. In accordance with Section 07600.

G. Expansion Joints

1. In accordance with ASTM D1056, Grade RE41E1.
2. Premolded, flexible cellular neoprene rubber filler strips.
3. Capable of compression up to 35 percent.

H. Control Joints

1. Designed to fit standard sash block and maintain lateral stability in masonry wall.
2. Polyvinyl chloride in accordance with ASTM D2287, General Purpose Grade, Designation PVC-63506.
3. Size and configuration as shown on the drawings.

I. Bond Breaker

1. Asphalt saturated organic roofing felt in accordance with ASTM D226, Type I (No. 15 asphalt felt).

J. Weep Holes

1. Plastic Tubing, medium density polyethylene.
2. Nominal size 1/4" inch wide x 3 inches long x 2 inches high.

PART 3 EXECUTION

3.01 PREPARATION

A. Protection

1. During construction of the masonry, securely cover top of walls with waterproof sheeting at end of each days work and at stoppages due to inclement weather.
2. Do not apply floor, roof or other concentrated loads to areas which will affect the masonry work for at least three (3) days after constructing the work.
3. Immediately remove grout or mortar from face of masonry to be left exposed.
4. Protect sills, ledges and other work from droppings of mortar and grout.

3.02 INSTALLATION

A. General

1. Install all items furnished under this Section in the finished work including items to be imbedded in concrete or masonry. Items to be attached to concrete or masonry after such work is completed shall be installed in accordance with the details shown on the Drawings. Fastening to wood plugs in masonry will not be permitted. All dimensions shall be verified at the site before fabrication is started.
2. No masonry shall be laid when the temperature is below 32 deg F, unless adequate means are provided for maintaining a temperature above 32 deg F during and for 48 hours subsequent to laying. The requirements for wetting brick shall also apply under these conditions. No frozen work shall be built upon. No masonry units having a film of frost on their surface shall be laid in the wall.
3. Both interior and exterior brickwork, concrete masonry units, shall be laid from scaffolds on the sides of walls from which the material is being laid. No overhead work will be permitted. Scaffolding shall be constructed and maintained in strict accordance with OSHA standards.
4. The Contractor shall familiarize the masons with the specifications of other trades that connect with their work and shall otherwise assure that proper cooperation is obtained.
5. The construction of exterior walls and partitions of rooms shall be scheduled to permit delivery and installation of all equipment, and the continuous operation of the facility without any interruption due to the construction.
6. All aluminum and steel surfaces to come in contact with exposed concrete or masonry shall receive a protective coating of an approved heavy bitumastic troweling mastic applied in accordance with the manufacturer's instruction prior to installation.

B. Horizontal Joint Reinforcement

1. Horizontal reinforcement of masonry joints shall be every 8-in. vertically which is equivalent to every course in block masonry and every third course in brick. Reinforcement shall act as ties where anchoring one type of masonry to another except as specified below.
2. Place as the work progresses.
3. Minimum cover of 5/8 inches on exterior faces and ½ inch at other locations.
4. Lap units ends at 6 inches minimum.
5. Use prefabricated "T" and "L" sections at corners and intersections.
6. Field fit sections only as recommended by the manufacturer.
7. Anchor as detailed on the Drawings.

C. Vertical wall reinforcement

1. Install in accordance with Section 04230.

D. Concrete Masonry Units (CMU)

1. Concrete masonry shall be laid up in Class M mortar as specified in Section 04100 and in the manner indicated on the Drawings
2. Where required by the Drawings, CMU partitions shall be built of units of thickness as shown. The partitions shall be built straight and plumb and in perfect alignment with cores set vertically with broken joints and carefully bedded in cement mortar. Except as otherwise shown on the Drawings, partition walls shall extend from floor construction to within 3/8 inch minimum of the slab or other construction above. Partitions shall be anchored to adjacent construction as indicated and as hereinafter specified.
3. Care shall be exercised in setting concrete masonry units around door bucks and window frames in order not to bulge the sides or change the position of the frames.
4. Before starting walls, pipe coverings or other projections shall be plumbed so that the full thickness of web of units will occur at all such projections. Walls shall be plumb and true to line.
5. Concrete masonry walls shall be laid out with one stretcher course of the units to define the spaces, location of doors and other openings, and to serve as a guide for other trades in the installation of their work. Sufficient opportunity shall be given to the various trades to install built-in work before proceeding with the walls, leaving openings where required for testing, etc., such openings to be closed up later. The first course of all partition walls shall rest directly on the structural slab and hollow units shall be set with cells vertical and filled with mortar to one-half the height of the block.

E. Sound Block

1. Installed by the masonry contractor using the best concrete masonry practices.
2. Laid in running bond in a full horizontal bed of mortar with the closed tops up. Slots shall face toward the room or area where sound absorption is required as shown on the Drawings. Slots shall be kept free of mortar and debris and the exposed mortar at the bottom of each slot shall be neatly tooled.
3. Joints shall be tooled and concave.
4. No broken, chipped or cracked units shall be used. Only quality units shall be installed. All defective units shall be rejected.

F. Brick Work

1. Brick masonry shall be laid up in Class M mortar as specified in Section 04100. The same class of mortar shall be used for face brick throughout the job to ensure uniformity of color.
2. Brick shall be laid in the manner indicated on the Drawings. The horizontal bed joints shall be completely filled with mortar and shall not be furrowed with the ends of the trowel. The cross joints shall be filled with mortar applied against the end of the brick,

which shall then be laid on the full, unfurrowed bed of mortar, and the brick shall be shoved tight up against the next brick already in place. The striking of the joints shall be done in such a way that they will be completely filled, leaving a smooth, hard, compact surface. A jointing tool shall then be used and the mortar shoved with force, so as to pack the mortar tight against the brick. Tooling shall form a slightly concave joint flush with the edges of the adjoining bricks.

3. To close the space between two other bricks, already laid, a trowel of fresh mortar shall be thrown against the end of each of these bricks, also on the flat brick, and the closure brick shall then be racked into placed. The intention is to get a completely filled bed and cross-joint.
4. Holes in joints caused by nails used for holding the line or from any other cause shall be filled before joint is struck or finished.
5. Courses of brick work shall be kept level, and the bond shall be accurately preserved. When necessary to bring any work to a required height, joints shall be adjusted uniformly to suit the conditions. Brickwork shall be laid to line and kept plumb and square.
6. At all times, up to the time that face bricks are ready to be laid, they shall be handled with brick tongs or by hand. Wheel-barrows shall be of the flat type. Bricks shall not be loosely dumped into barrows or onto scaffolds. Damaged brick shall not be used in exposed wall surfaces.
7. Joints, unless otherwise indicated, shall be as nearly as possible of one size and shall be approximately 3/8 inch wide. After the mortar has taken its initial set, the joints shall be tooled to a slightly concave surface with a jointer which shall make a smooth, even joint without discoloration.
8. Unfinished work shall be stepped back for joining with new work; toothing may be resorted to only when specifically approved by the Engineer. Before new work is started, all loose mortar shall be removed and the exposed joint thoroughly wetted not less than 12 hours before laying new work.

G. Accessories

1. Anchors and Ties.
   a. As the brickwork proceeds, make provisions for the installation of all anchors, ties, reinforcing, and dowels as hereinafter specified, as shown on the Drawings, required for this trade.
   b. Build-in all similar items required for and furnished by other trades, strictly in accordance with the instructions of those for whose use they are provided.
   c. Anchors except for strap anchors shall be as shown on the Drawings.
   d. Corrugated wall ties shall be provided for bonding face brick to brick and tile backing, except where brick reinforcement or bonders are used. One tie shall be placed on each brick in every sixth course.
   e. Concrete masonry unit walls shall be bonded with approved metal ties in alternate courses, spaced 24 inches horizontally. The ends of ties shall be set so that they overlap 3 inches beyond ties set below.
   f. Dovetail anchors shall set be set in galvanized dovetail slot. Anchor shall be installed at 16 inches O.C. vertical.

2. Flashing
   a. As the brickwork and backup proceeds, make provision for the installation of flashing. Carefully follow the Drawings and recommendations of the manufacturer for this procedure. All headers and bonding are to be arranged and carried out as required to provide for the proper installation of the flashing as shown. A smooth mortar surface shall be provided to receive all flashing.

b. Flashings and cap flashings shall be built-in and pointed upward. Cutting chases for flashing will not be permitted. Masonry work built without required built-in flashing shall be demolished and built properly.

3. Premoulded Joint Filler
   a. Joint filler shall be placed in masonry walls at control joints and elsewhere as shown for the masonry on the Drawings.
   b. Thickness shall be as shown on the Drawings.
   c. Caulking for sealing joint filler is specified elsewhere in these Specifications.
4. Weep Holes
   a. Install in the vertical mortar joints of the facing brickwork on 24-in. centers just above lintel angles and at the bottom of the cavity.
   b. The weep holes shall be installed by placing preformed plastic weep holes in the vertical joints.

H. Chases and Recesses

1. Chases for pipes or ducts shall be provided as shown on the Drawings or as directed. These shall not be covered until all tests are completed. Where pipes are enclosed, masonry shall be kept clear of pipes and fittings in order to allow free movement of pipe work. The Contractor shall obtain the approval of the Engineer in writing before building or cutting any chase in excess of 4 inches deep and 8 inches wide, except where shown on the Drawings.
2. Recesses shall be provided in all brick work for cabinets, outlets, grilles and other miscellaneous appurtenant work where shown on the Drawings or directed by the Engineer. Work, including that furnished and installed by others, which comes within the brick work shall be neatly built-in having all brick fitted about such work.

I. Opening for Ducts

1. Where ducts pass through brick walls or pass through masonry unit partitions, the steel lintels shall be set over the openings before proceeding with the work over openings.
2. Where outlets for registers, radiator enclosures, grilles and other similar work branch out of walls, shafts and vertical ducts, the frames furnished under another Section of these Specifications shall be built-in. Partitions shall not be cut to receive the register or other frames.

J. Door Frames and Bucks

1. Before building any work around or against bucks or frames, the Contractor shall check and inspect the frames and bucks to determine the following:
   a. Units are set plumb, square and in proper position.
   b. Proper anchors are fastened in place for building into masonry.
   c. Electric conduits are not housed in bucks in a manner that would prevent full extension of buck anchors.
2. Joints between masonry and bucks shall be completely filled with mortar. All anchors shall be securely set into the masonry and thoroughly slushed with mortar. If bucks or steel frames are loose after being set, holes shall be drilled in units at heads, over lines of jambs, and voids in jambs completely filled with cement grout.
3. Point neatly around all door and sash frames and other trim.

K. Setting louvers and frames

1. Louvers and frames shall be set plumb and square. The braces or stays shall not be removed until the frames are built-in and properly secured in the walls. All louvers shall be built-in with the brickwork where possible. Masonry openings shall be plumb, square, true to line and of proper dimensions for louvers. Proper slots at jambs and heads shall

be provided to receive louver jamb plates. All necessary mortar pointing around window frames shall be done after they are installed, leaving them in condition ready for caulking.

L. Steelwork

1. Loose lintels, templates, and other miscellaneous steel shall be built into masonry in accordance with details on the Drawings and as required by the trade furnishing said work.

M. Blocking

1. Wood strips and blocking for fastening flashing or other metal work shall be placed strictly in accordance with details on the Drawings and the instructions of the trade for whom they are required.

N. Cutting and Patching

1. No masonry work shall be cut or patched without the permission of the Engineer.
2. Patching and replacing of masonry work shall be carefully done.

3.03 CLEANING

A. All mortar shall be allowed to thoroughly cure before cleaning. Adequate water supply shall be available to assure thorough presoaking and thorough rinsing of the surface. All surrounding non-masonry surfaces shall be tested and/or protected from exposure to the cleaning compound.

B. All traces of excess mortar/grout, efflorescence, and other construction stains shall be removed from all exposed masonry surfaces.

C. Masonry cleaning compound shall be SURE KLEAN No. 600 Detergent as manufactured by ProSoCo Inc., Kansas City, KA, or equal. Use shall be in strict accordance with manufacturers printed instructions.

D. Avoid using hydrochloric (muriatic) acid containing cleaners which discolor the mortar.

E. As the cleaning work progresses, all joints shall be examined to locate cracks, holes, or other defects, and all such shall be carefully pointed up and filled with mortar. Where necessary, in the opinion of the Engineer, the joints shall be cut out and repointed with setting mortar of the same color as that of the original and adjoining work

END OF SECTION

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SECTION 04210

ARCHITECTURAL FACE BRICK

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Brick units.

2. Reinforcement, anchors, and accessories.

B. Related Work: The following items are not included in this Section and are specified under the designated Sections:

1. Section 03400 – PRECAST CONCRETE.

2. Section 04220 – REINFORCED UNIT MASONRY.

3. Section 05500 – METAL FABRICATIONS.

4. Section 06100 – ROUGH CARPENTRY.

5. Section 07620 – SHEET METAL FLASHING AND TRIM

6. Section 07920 – JOINT SEALANTS.

7. Division 16 – Electrical for flush exterior outlets and keycard access.

1.2 REFERENCES

A. ASTM A153 - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

B. ASTM C 216 - Standard Specification for Facing Brick (Solid Masonry Units Made from Clay or Shale).

C. ASTM D 1056 - Standard Specification for Flexible Cellular Materials - Sponge or Expanded Rubber.

1.3 SUBMITTALS

A. Submit under provisions of Section 01300 - Administrative Requirements.

B. Selection Samples: For each product specified, two complete samples of brick to reflect the full range of color, shades and surface texture of brick specified.

C. Verification Samples: For each product specified, two samples of four brick each,

representing actual product, color, and texture.

D. Manufacturer's Certificates: Certify products meet or exceed specified requirements.

1.4 MOCKUP

A. As soon as the brick and stone samples have been approved, deliver enough brick to the job site to construct a 2-foot-high by 3-foot-wide mockup wall panel.

B. Construct the mockup panel using the brick, mortar, reinforcing, weep holes, tooling, and cleaning as specified, with appropriate backup walls as shown on the Drawing.

C. The approved sample panel shall be a standard of workmanship for the Work and if accepted, incorporated into project.

D. As construction proceeds, the first full panel of brickwork, between expansion joints shall become the standard of workmanship for issues, such as head joint alignment, that are not apparent on the smaller mockup panel.

E. Mockup panel shall not be removed until masonry work required by this Section has been completed and accepted.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle materials to prevent inclusion of foreign materials and damage by water or weather. Store packaged materials in their original packages. Remove damaged or deteriorated materials from the premises

1.6 PROJECT CONDITIONS

A. Follow hot weather and cold weather requirements in the masonry code and specifications, TMS 402 and TMS 602.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers
   1. Basis of Design: Belden Brick Company
   2. Acme Brick Company
   3. Stiles and Hart Brick Company

B. Requests for substitutions will be considered in accordance with provisions of Section 01600 – PRODUCT REQUIREMENTS.

2.2 BRICK UNITS

A. Face Brick: Brick shall be Type FBS or HBS as follows:
   1. Modular in size, 2-1/4 by 3-5/8 by 7-5/8 inches, and conform to the requirements of ASTM C 216, Grade SW.
   2. Closure 3-5/8 by 3-5/8 by 7-5/8 inches and conform to the requirements of

ASTM C 216, Grade SW.

3. Other Sizes: Soldier courses as indicated in the drawings.

B. Special shape face bricks shall be as detailed and at locations as indicated on the Drawings.

C. Furnish special uncored face brick in locations where cores would be exposed in finish work.

D. Color:
   1. Basis of Design: Belden Brick
      a. Sugarcreek Plant 4
         1) Modular Colony Red
   2. Light gray sanded mortar.
   3. Control joint to match mortar.

2.3 ANCHORS AND TIES

A. Acceptable Manufacturers:
   1. Products of Hohmann and Barnard and Heckman Building Products, conforming to specification requirements are acceptable.

B. Requests for substitutions will be considered in accordance with provisions of Section 01600 – PRODUCT REQUIREMENTS.

C. Anchors:
   1. Slotted anchors of type DW10 shall be used with steel stud or wood stud backup walls unless noted otherwise.
   2. Dur-O-Eye or equal anchors welded to joint reinforcing shall be used with masonry backup walls. Missing or damaged anchors shall be replaced as necessary with DW10 anchors fastened to wall with corrosion resistant Tapcon screws.
   3. Zinc coating shall comply with ASTM A153-B2.

2.4 ACCESSORlES

A. Weep Holes: Open head joints every third brick at lintels and other locations.

B. Compressible Filler: Premolded, flexible cellular neoprene rubber filler strips complying with ASTM D 1056, Grade RE41E1, capable of compression up to 35 percent of width and thickness indicated.

C. Mortar Net: Provide continuous Mortar Net along base of air space to catch mortar drippings. High-density polyethylene, 90 percent open mesh, dovetail shape.

D. As an alternate to Mortar Net, every third brick may be left out at base of air space and cavity cleaned and inspected to be free of mortar droppings.

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not begin installation until backup substrates have been properly prepared.

B. Verify field conditions are acceptable and are ready to receive work.

C. Verify built-in items are in proper location, and ready for roughing into masonry work.

D. If backup substrate and other preparation work is unsatisfactory, notify the Architect before proceeding.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Furnish temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent support.

3.3 INSTALLATION

A. Pre-wet all brick having initial rate of absorption greater than 30 before laying.

B. Heat water and sand in cold weather. Do not lay brick in temperature below freezing unless such heating of materials and protection of work is properly provided for.

C. Lay brickwork true to dimensions, plumb, square, and in bond. All courses shall be level with joints of uniform width and height.

D. Vertical joints in facing bond work shall be spaced so as to line up plumb and true, and all joints shall be as uniform as the type of brick will allow.

E. Lay facing brick in full mortar bed with shoved head joints. Completely fill joints with mortar. Do not deep furrow bed joints.

F. Allow space for caulking of joints at frames.

G. Bond for facing brick shall be running bond unless otherwise indicated on the Drawings. Match existing bond patterns unless noted otherwise.

H. Anchor facing brick to metal studs or masonry backup at 16 inches o.c. vertically and 16 inches o.c. horizontally with adjustable anchors and ties.

I. Joint thickness shall be such as to provide coursing pattern to match existing brickwork. When the joints have become thumbprint hard, all exposed joints shall be tooled with a sled-jointing tool. The jointer shall be larger than the width of the joints so that a complete contact is made along the edges of the units, compressing and sealing the surface of the joint. Joints shall be pointed as the tool proceeds.

J. Form weep holes in head joints at face brick over shelf angles and lintels and where shown on the Drawings. Rake out bed joint mortar to clean flashing surface. Weep

holes shall be filled with preformed mesh type vent at bottom of head joints not more than 24 inches o.c.

K. Keep air space clean of mortar at all times. Where brick extends below grade, fill brick cavity solid to level of flashing and slope mortar slightly to outside under flashing.

L. When flashing is to be laid on or against masonry, the surface of the masonry shall be smooth and free from projections that might puncture the flashing material.

M. Where fresh masonry joins masonry that is partially set or totally set, the exposed surface of the set masonry shall be cleaned and lightly wetted so as to obtain the best possible bond with the new work. All loose brick and mortar shall be removed.

N. Expansion Joints:
1. Vertical: Locate where indicated on Drawings. Lay units to form a vertical joint free of mortar and of same width as normal head joint.
2. Horizontal: Locate under shelf angles and other dissimilar materials abutted by brick. Maintain a clear space at least 1/4-inch thick free of mortar. Inspect with trowel before installing backer rod and sealant.
3. Sealant. Shall be in accordance with Section 07920 – JOINT SEALANTS.

3.4 FLASHING

A. Build in, as the work progresses all flashings which enter the masonry as specified in Sections 07620 SHEET METAL FLASHING AND TRIM.

B. Extend all flexible flashing 1 inch past face of wall and trim after tooling joints.

C. Where metal flashing or drip edge is shown, align drip with face of brick. Edge of flashing or drip edge shall be a simple hem rolled edge and not turned down.

3.5 OPENINGS AND HOLES

A. Provide all chases and recesses in masonry work of all types as indicated on the Drawings and as required for pipes, ducts, and other work of Mechanical and Electrical trades. Such work shall be accurately located by the trades requiring the work, but masonry work shall not be constructed without giving other trades due notices and opportunity to lay out or install such items as may be required for their work.

B. Where required for installation of work of other trades, leave openings as indicated on the Drawing or as required to receive a later installation.

C. After work of other trades is in place, openings shall be neatly filled with masonry of the same type as in the adjoining surfaces.

3.6 SETTING AND BUILDING-IN

A. Build-in materials occurring in any type of masonry construction that are furnished by other trades. All built-in work shall be accurately placed, secured, held in position, and located by the trade requiring the work.

B. Set and built -in items of related miscellaneous iron such as loose lintels and anchors required to complete all parts not connected to building framing.

C. Set all anchor bolts required for the attachment of work to masonry.

D. Build-in recesses, flashings, receivers, slots, anchors, sleeves and other work shown on Drawings.

3.7 CLEANING

A. After tooling and pointing is done, clean face brick surface with dry brush.

B. After 3 days clean with water and mild detergent or cleaners recommended by brick manufacturer. Do not use muriatic acid.
   1. Wet brick surfaces thoroughly before applying cleaning solution.
   2. Apply cleaning solution with bucket and brush or low-pressure spray.
   3. Remove all stains and mortar streaks using stiff fiber bristle brush.
   4. Rinse thoroughly with water.
   5. Protect windows, landscaping, and surrounding masonry surfaces from cleaning solution and rinse water.

END OF SECTION

SECTION 04230

REINFORCED UNIT MASONRY

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes

1. Requirements for furnishing all required labor, materials, accessories, tools, apparatus and equipment for the reinforced masonry work shown on the Drawings and described in the Specifications.
2. Requirements of Section 04200 – Unit Masonry apply to work in this section.

B. Related Sections

1. Section 04100 - Mortar and Masonry Grout
2. Section 04200 – Unit Masonry

1.02 REFERENCES

A. American Society for Testing Materials (ASTM)

1. A615, Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
2. C476, Specification for Grout for Masonry.

1.03 SUBMITTALS

A. In accordance with Section 01300.

1. Submit Shop Drawings for fabrication, bending and placement of reinforcement bars.
2. Comply with ACI 315 “Manual of Standard Practice for Detailing Reinforced Concrete Structures”

PART 2 PRODUCTS

2.01 MATERIALS

A. General

1. Refer to Section 04200 for masonry materials not included in this section.

B. Reinforcing Bars

1. In accordance with ASTM A615, Grade 60, unless indicated otherwise on the Drawings.
2. Size and spacing as indicated on the Structural Drawings.
3. Shop fabricate reinforcing bars which are shown to be bent or hooked.
4. All vertical reinforcing shall be installed using vertical bar positioners, as manufactured by Dur-O-Wall or equal, for locating the reinforcement in the center of the cells.

C. Mortar and Grout in accordance with Section 04100.

PART 3 EXECUTION

3.01 INSTALLATION OF REINFORCEMENT

A. General

1. Clean reinforcement of loose rust, scale, earth, ice or other deleterious material.
2. Do not use reinforcement which is deformed, severely rusted or not as shown on the approved shop drawings.

B. Positioning Reinforcement

1. Position reinforcement accurately as indicated on the Drawings.
2. Securely support bars to avoid displacement during grouting operation.
3. Minimum clearances, unless indicated on Drawings are as follows:
   a. Where vertical bars are in close proximity, provide a minimum of 1 inch or a nominal bar diameter between bars, whichever is greater.
   b. Where vertical bars are placed for columns, piers and pilasters, provide a minimum of 1 ½ inches or a 1 ½ times the nominal bar diameter between bars, whichever is greater.

C. Splicing

1. Locations as indicated on the Drawings.
2. Provide laps as indicated.

D. Horizontal Joint Reinforcement

1. Place as the work progresses.
2. Minimum cover of 5/8 inches on exterior faces and ½ inch at other locations.
3. Lap units ends at 6 inches minimum.
4. Use prefabricated “T” and “L” sections at corners and intersections.
5. Field fit sections only as recommended by the manufacturer.
6. Anchor as detailed on the Drawings.

E. Vertical wall reinforcement

1. Place reinforcement before grouting.
2. Installed using in one of two methods as the wall progresses.
   a. The first method, the vertical reinforcing bars may be installed into the masonry cells after each of 4’ of wall is placed, but before grouting, this method will require the bars to pass through a minimum of two bar positioners in the 4’ lift.
   b. The second method requires the upper bars to be installed tied to the lower bars, or foundation dowels, with tie wire as specified under Section 03200 and pass through only one vertical bar positioner located at the bottom of the last course for each lift. The Contractor's attention is directed to the fact that with the second method the masonry blocks will need to be lifted over the rods already in position. Vertical wall reinforcing shall be lapped a minimum of 48 bar diameters (# 5’s - 30”; # 6’s - 36”; #7’s - 42”). Grouting of the masonry cells shall conform to this Section using grout as specified in Section 04100. Masonry wall reinforcing shall be supplied in lengths equal to the maximum grout lift (4’) plus the required lap lengths as specified above.

3.02 INSTALLATION OF REINFORCED CONCRETE UNIT MASONRY (CMU)

A. General

1. Install CMU dry without wetting.

2. Lay CMU with full face mortar bed.
3. Fill joints between CMU solidly with mortar.
4. Solidly bed cross-webs of starting courses in mortar.
5. Head and bed joint width to be 3/8 inched unless indicated otherwise on the Drawings.

B. Walls

1. Lay CMU wall units in ½ running bond with vertical joints in each course centered with courses above and below unless indicated otherwise on the Drawings.
2. Maintain alignment of cells which are to be reinforced and grouted, Provide minimum clearance dimensions indicated, solidly bed webs in mortar where adjacent to reinforced cores. Keep cavities to be grouted free of mortar.
3. Interlock corners and intersections.
4. Use special shaped units as required for jambs, sashes, joints, lintels, bond beams or as otherwise indicated on the drawings.

C. Columns, Piers, Pilasters

1. Use CMU of the size and shape indicated on the Drawings. If not shown use units which provide minimum clearances for the size of reinforcement shown.
2. Where bonded pilaster construction is indicated, lay wall and pilaster units together.

D. Grout Selection

1. Use fine grout (ASTM C476) for filling cavities 4 inches or less in any horizontal direction.
2. Use course grout (ASTM C476) for filling cavities greater than 4 inches in any horizontal direction.

E. Grout Method

1. Prior to placing grout.
   a. Inspect and clean cavities to receive grout.
   b. Clean and adjust reinforcement.
   c. Clean surface of structural member supporting the masonry to ensure bond with grout.
   d. Close cleanout holes, and brace to resist grout pressure.
2. Placing grout will not be allowed until the masonry has attained sufficient strength.
3. Grout to be placed by pumping unless an alternate method is approved by the Engineer.
4. The Contractor has the option of using either low-lift or high-lift grouting procedures in accordance with this specification as approved by the Engineer.
   a. Low Lift Grouting
      1) Requires minimum clear dimension of 2 inches and clear area of 8 sq. inches in vertical cores to be grouted
      2) Vertical reinforcement to be placed prior to laying CMU. Extend above pour height to allow splicing as required. Support bars at maximum 10 foot intervals.
      3) Lay CMU to pour height not to exceed 4 feet or below bond beam, which ever is less.
      4) Pour grout using delivery system appropriate for the job, minimizing spillage. Rod or vibrate grout during placement, Place in continuous operation. Fill CMU to 1 ½ inches below top of course.
      5) After grouted masonry has cured, lay masonry and place reinforcement for the next pour before grouting. Repeat as required.
   b. High Lift Grouting
      1) Requires minimum clear dimension of 3 inches and clear area of 10 sq. inches in vertical cores to be grouted
      2) Provide clean out holes in first course of all cavities to be filled with grout.

3) Construct wall to full height of grout pour as allowed.
4) Place grout in 5 foot lifts maximum to a total height of 24 feet for single wythe hollow concrete masonry walls unless indicated otherwise.
5) Allow not less than 30 minutes or more than 1 hour between lifts.
6) Pour grout using delivery system appropriate for the job, minimizing spillage. Rod or vibrate grout during placement, Place in continuous operation. Fill CMU to 1 ½ inches below top of course.

F. Bond Beams

1. Pour grout to 1 ½ inches below bond beam course.
2. Place horizontal reinforcement in bond beams lapping corners and intersections.
3. Place grout in bond beam before filling vertical cores above bond beam.

END OF SECTION

DIVISION 05

SECTION 05120

STRUCTURAL STEEL FRAMING

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

1. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section of the Specifications.

    a. Structural Steel.
    b. Architecturally exposed structural steel.

2. Related Work: The following items are not included in this Section and will be performed under the designated Sections:

    a. Section 05500 – METALS FABRICATION

1.02 DEFINITIONS

Structural Steel: Elements of structural-steel frame, as classified by AISC's "Code of Standard Practice for Steel Buildings and Bridges", that support design loads.

A. Architecturally Exposed Structural Steel: Structural steel that forms a prominent architectural feature in a building or structure or designated as architecturally exposed structural steel on the Drawings.

1.03 PERFORMANCE REQUIREMENTS

Connections: Provide details of connections required by the Contract Documents to be selected or completed by the structural-steel fabricator to withstand loads indicated and comply with other information and restrictions indicated.

Select and complete connections using the American Institute of Steel Construction’s (AISC) "Manual of Steel Construction, Load and Resistance Factor Design", Volume 2, Part 9.

Engineering Responsibility: Fabricator's responsibilities include using a qualified professional engineer to prepare structural analysis data for structural-steel connections.

1.04 SUBMITTALS

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

B. Shop Drawings: Show fabrication of structural-steel components.
    1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.

    2. Include embedment drawings.

    3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length and type of each weld.

4. Indicate type, size and length of bolts, distinguishing between shop and field bolts. Identify pre-tensioned and slip-critical high-strength bolted connections.

5. For structural-steel connections indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

C. Welding Certificates: Certificate from AWS indicating certification in type of welding required for each welder and welding operator.

D. Welding Records and Data:

1. Before welding, submit the procedure which will be used for qualifying welders and welding procedures. For procedures other than those pre-qualified in accordance with AWS D1.1, submit a copy of procedure qualification test records.

2. Submit certified copy of qualification test records for each welder, welding operator, and tacker who will be employed in the work.

3. If field welding is permitted, submit descriptive data for field welding equipment.

4. Submit all NDE records (radiographs, ultrasonic, magnetic particle) and visual inspection reports upon completion or when otherwise requested by the Engineer.

E. Qualification Data: For installer, fabricator, professional engineer, testing agency, welding inspectors, NDE inspectors and galvanizer. Submit prior to starting work.

F. Mill Test Reports: Signed by manufacturers certifying that the following products comply with requirements:

1. Structural steel including chemical and physical properties.
2. Bolts, nuts, and washers including mechanical properties and chemical analysis.
3. Direct-tension indicators.
4. Tension-control, high-strength bolt-nut-washer assemblies.
5. Shear stud connectors.
6. Shop primers.
7. Nonshrink grout.

1.05 QUALITY ASSURANCE

A. Fabricator Qualifications: A qualified fabricator who participates in the AISC Quality Certification Program and is certified for: Steel Building Structures (STD).

B. Galvanizer Qualifications: Engage the services of a qualified galvanizer who has demonstrated a minimum of five years experience in the successful application of galvanized coatings specified in this Section in the facility where the work is to be performed and who will apply the coatings within the same facility.

C. Installer Qualifications: A qualified installer with previous experience in installing structural steel.

D. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel".

E. Comply with applicable provisions of the following specifications and documents:

1. AISC's "Code of Standard Practice for Steel Buildings and Bridges"

2. AISC's "Seismic Provisions for Structural Steel Buildings" and "Supplement No. 2"

3. AISC's "Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design" and "Load and Resistance Factor Design Specification for Structural Steel Buildings"

4. AISC's "Specification for the Design of Steel Hollow Structural Sections"

5. AISC's "Specification for Allowable Stress Design of Single-Angle Members" and "Specification for Load and Resistance Factor Design of Single-Angle Members"

6. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts"

F. Tests and Inspection

1. The Contractor will test and inspect high-strength bolted connections and welded connections and prepare test reports. Specialty tests shall be performed at no expense to the Owner by an independent testing laboratory approved by the Engineer. Costs of specialty tests shall be borne by the Contractor. Test reports shall be submitted to the Engineer for approval.

2. The Engineer reserves the right to inspect high-strength bolted connections and weld connections. Provide access to places where structural steel work is being fabricated or erected so that required inspection and testing can be accomplished at no change in Contract Price. At times, inspection may require moving or handling of steel to permit proper inspection. Notify Materials Testing Laboratory not less than 48 hours prior to start of fabrication.

3. The Engineer may inspect structural steel at the plant before shipment; however, the Engineer reserves the right, at any time before final acceptance, to reject material not complying with specified requirements.

4. Correct deficiencies in structural steel work that inspections and laboratory test reports have indicated to be not in compliance with requirements at the Contractor's expense. Perform additional tests, at no expense to the Owner, as may be necessary to reconfirm any non-compliance of the original work, and as may be necessary to show compliance of corrected work.

5. Specialty Tests: Nondestructive examination of welds in accordance with provisions of AWS D1.1 and ASTM Standards noted shall be made in accordance with the following schedule:

a. Radiographic Examination of Welds, per ASTM E94 and E142:

1) Field, complete joint penetration groove welds:

a. 1 out of 5 (20 percent) with thickness equal to or less than 3/4 inch.
b. 100 percent with thickness greater than 3/4 inch.

2) Shop, complete joint penetration groove welds:

a. 1 out of 10 (10 percent) with thickness equal to or less than 3/4 inch.
b. 1 out of 2 (50 percent) with thickness greater than 3/4 inch and equal to or less than 1-1/2 inches.
c. 100 percent for thickness greater than 1-1/2 inches.

b. Ultrasonic Examination, per ASTM E164: Complete joint penetration groove butt welds not accessible for radiographic examination shall be subjected to ultrasonic testing. The extent shall be the same as noted for radiographic examination. Ultrasonic examination shall be made 48 to 72 hours after welding at locations on weldments or welded joints subject to high restraint as indicated in order to check for lameller tearing. The exact location of the areas to be inspected shall be determined with the Engineer at the time of fabrication. This examination shall be made according to the following schedule unless conditions of tearing require a greater number of tests, as directed:

1) 1 out of 10 (10 percent) for thickness equal to or less than 3/4 inch.
2) 1 out of 5 (20 percent) for thickness greater than 3/4 inch and equal to or less than 1-1/4 inches.
3) 1 out of 2 (50 percent) for thickness greater than 1-1/4 inches.

c. Magnetic Particle Examination, per ASTM E709, field and shop:
1) 1 out of 5 (20 percent) of complete joint penetration groove welds of tee and corner joints.
1) 1 out of 10 (10 percent) of partial joint penetration groove and fillet welds.

d. Penetrant Examination, per ASTM E165: Shall be used for detecting discontinuities that are open to the surface use as appropriate.

6. Visual Examination: All welds whether otherwise examined or not shall be visually examined and faulty joints shall be marked for correction.

7. When any testing, examination or inspection reveals faulty welds, all joints of the same type shall be checked at no expense to the Owner until the integrity of the weld is assured before resuming examination.

8. After faulty welds have been corrected or repaired, they shall each be re-examined at no expense to the Owner in the manner specified for the original joint.

9. It is intended that inspections shall be performed to permit an orderly flow of completed material from the shop. Work with the Engineer to establish a schedule that will permit this.

10. Test result information shall be forwarded to the Engineer immediately after test results are available stating the acceptance or rejection of fabricated pieces in order that the repairs and re-inspection may be made as soon as possible.

G. Pre-Installation Conference: Contractor shall schedule a meeting to be attended by Contractor, Engineer, fabricator and galvanizer. Agenda shall include the following: Project schedule, source for each fabrication, coordination between fabricator and galvanizer and adjacent Work, finish of surfaces, application of coatings, submittals, and approvals.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from erosion and deterioration.

1. Store fasteners in a protected place. Clean and re-lubricate bolts and nuts that become dry or rusty before use.

2. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.

1.07 COORDINATION

A. Furnish anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions and directions for installation.

PART 2 – PRODUCTS

2.01 STRUCTURAL-STEEL MATERIALS

A. S-Shapes, W-Shapes: ASTM A 992, Grade 50.

B. Channels, Angles, Plates and Bar: ASTM A 36.

C. Cold-Formed Hollow Structural Sections: ASTM A 500, Grade B, structural tubing.

D. Steel Pipe: ASTM A 53, Type E or S, Grade B.

E. Medium-Strength Steel Castings: ASTM A 27, Grade 65-35 carbon steel.

F. High-Strength Steel Castings: ASTM A 148,Grade 80-50, carbon or alloy steel.

G. Welding Electrodes: Comply with AWS requirements.

2.02 BOLTS, CONNECTORS, AND ANCHORS

A. High-Strength Bolts, Nuts, and Washers: ASTM A 325, Type 1, heavy hex steel structural bolts; ASTM A 563 heavy hex carbon-steel nuts; and ASTM F 436 hardened carbon-steel washers.

1. Finish: Hot-dip zinc coating, ASTM A 153, Class C.

B. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F 1852, Type 1, steel structural bolts with splined ends; ASTM A 563 heavy hex carbon-steel nuts; and ASTM F 436 hardened carbon-steel washers. Finish, mechanically deposited zinc coating, ASTM B 695, Class 50.

C. Shear Connectors: ASTM A 108, Grades 1015 through 1020, headed-stud type, cold-finished carbon steel; AWS D1.1, Type B.

D. Anchor Rods: ASTM F 1554, grade as applicable, hot-dip zinc coating, ASTM A 153, Class C.

E. Threaded Rods: ASTM A 193, grade as applicable, hot-dip zinc coating, ASTM A 153, Class C.

F. Eye Bolts and Nuts: ASTM A 108, Grade 1030, cold-finished carbon steel.

G. Sleeve Nuts: ASTM A 108, Grade 1018, cold-finished carbon steel.

2.03 MISCELLANEOUS MATERIALS

A. Galvanizing Repair Paint: Coatings meeting requirements of ASTM A 780.

B. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

2.04 FABRICATION

A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and AISC's "Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design".

1. Camber structural-steel members where indicated.

2. Identify high-strength structural steel according to ASTM A 6/ A 6M and maintain markings until structural steel has been erected.

3. Mark and match-mark materials for field assembly.

4. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.

B. Architecturally Exposed Structural Steel: Comply with fabrication requirements, including tolerance limits, of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for structural steel identified as architecturally exposed structural steel.

1. Fabricate with exposed surfaces smooth, square, and free of surface blemishes including pitting, rust, scale, seam marks, roller marks, rolled trade names, and roughness.

2. Remove blemishes by filling or grinding or by welding and grinding, before cleaning, treating, and shop priming.

C. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1.

D. Bolt Holes: Cut, drill, or punch standard bolt holes perpendicular to metal surfaces.

E. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.

F. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1 and manufacturer's written instructions.

G. Steel Wall-Opening Framing: Select true and straight members for fabricating steel wall-opening framing to be attached to structural steel. Straighten as required to provide uniform, square, and true members in completed wall framing.

H. Welded Door Frames: Build up welded door frames attached to structural steel. Weld exposed joints continuously and grind smooth. Plug-weld fixed steel bar stops to frames. Secure removable stops to frames with countersunk, cross-recessed head machine screws, uniformly spaced not more than 10 inches o.c., unless otherwise indicated.

I. Holes: Provide holes required for securing other work to structural steel and for passage of other work through steel framing members.

1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.

2. Base-Plate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.

3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

2.05 SHOP CONNECTIONS

A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.

B. Weld Connections: Comply with AWS D1.1 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work. Complete welds in accordance with the Contract Drawings.

1. Remove backing bars or runoff tabs, back gouge, and grind steel smooth.

2. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for mill material.

3. Insufficient welds shall be rejected and corrected until required profiles are met.

4. Verify that weld sizes, fabrication sequence, and equipment used for architecturally exposed structural steel will limit distortions to allowable tolerances. Prevent weld show-through on exposed steel surfaces.

    a. Grind butt welds flush.
    b. Grind or fill exposed fillet welds to smooth profile. Dress exposed welds.

5. No skip welds will be permitted for steel connections to be coated.

2.06 STEEL PRIMERS AND FINISHES

A. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for The Society for Protective Coatings (SSPC) surface preparation specifications and environmental exposure conditions of installed metal fabrications:

1. Exteriors (SSPC Zone 1B) and Items Indicated to Receive Zinc-Rich Primer: SSPC-SP 10/NACE No. 2, "Near White Metal Blast Cleaning"

2. Interiors (SSPC Zone 1A): SSPC-SP 6, "Commercial Blast Cleaning"

3. Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finishes and those to be field welded, embedded in concrete or masonry, unless otherwise indicated. Extend priming of partially embedded members to a depth of 2 inches.

4. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel" for shop painting.

5. Comply with SSPC-PA 2, "Measurement of Dry Coating Thickness with magnetic Gages"

B. Zinc-Rich Primer: Urethane zinc rich primer compatible with topcoat Specified in Section 09900. Provide primer with a VOC content of 340 g/L (2.8 lb/gal.) or less per OTC ozone standards. Provide Tnemec Series 394 or Ameron 5105 or equal by DuPont or Carboline for exposed steel to be fireproofed, or Tnemec Series 901K97 Series or 90-97 or Ameron 68HS or equal by DuPont or Carboline for exposed steel to be finish painted at 3.0 mils DFT.

C. Primer for Exposed Steel to Receive Multi-Coat Shop-Applied Coating: Tnemec Series 901K97 or 90-97 urethane zinc rich primer at 3.0 to 3.5 mils DFT, topcoated in shop with Tnemec Series V73 Endura-Shield, or use Ameron Series 68HS Primer at 3.0 to 5.0 mils DFT topcoated in shop with Ameron's Amercoat 450H, or use or equal primers and finish coats from DuPont or Carboline.

D. 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. Comply with ASTM A 123 for fabricated products and ASTM A 153 for hardware. Provide thickness of galvanizing specified in referenced standards. The galvanizing bath shall contain high grade zinc and other earthly materials. Fill vent holes and grind smooth after galvanizing.

E. Hot-Dip Galvanizing And Factory-Applied Primer for Steel: Provide hot-dip galvanizing and factory-applied prime coat, certified OTC/VOC compliant less than 2.8 lbs/gal. and conforming to EPA and Commonwealth of Massachusetts requirements. Apply primer within 12 hours after galvanizing at the galvanizer's plant in a controlled environment meeting applicable environmental regulations and as recommended by the primer coating manufacturer. Blast cleaning of the surface is unacceptable for surface preparation. Primer shall have a minimum two year re-coat window for application of finish coat. Coatings must meet or exceed the following performance criteria:

1. Abrasion: ASTM D 4060, CS17 Wheel, 1,000 gram load.
2. Adhesion: ASTM D 3359, Method B, 5 mm crosshatch.
3. Humidity Resistance: ASTM D 4585.
4. Salt Spray (Fog): ASTM B 117.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments, with steel erector present, for compliance with requirements. Elevations shall be verified by a surveyor licensed in the Commonwealth of Massachusetts.

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

3.02 PREPARATION

A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place, unless otherwise indicated. Do not remove temporary shoring supporting composite deck construction until cast-in-place concrete has attained its design compressive strength.

3.03 ERECTION

A. Set structural steel accurately in locations and to elevations indicated and according to AISC's "Code of Standard Practice for Steel Buildings and Bridges".

B. Base and Bearing Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting base and bearing plates. Clean bottom surface of base and bearing plates.

1. Set base and bearing plates for structural members on wedges, shims, or setting nuts as required.
2. Weld plate washers to top of base plate.

3. Snug-tighten or pretension anchor rods as applicable after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of base or bearing plate before packing with grout.

4. Promptly pack grout solidly between bearing surfaces and base or bearing plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.

C. Maintain erection tolerances of structural steel and architecturally exposed structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges".

D. Align and adjust various members forming part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

1. Level and plumb individual members of structure.
2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.

E. Splice members only where indicated.

F. Remove erection bolts on welded, architecturally exposed structural steel; fill holes with plug welds; and grind smooth at exposed surfaces.

G. Do not use thermal cutting during erection unless approved by Engineer. Finish thermally cut sections within smoothness limits in AWS D1.1.

H. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

I. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1 and manufacturer's written instructions.

3.04 FIELD CONNECTIONS

A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint indicated on the Drawings.

B. Weld Connections: Comply with AWS D1.1 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work.

1. Comply with AISC's "Code of Standard Practice for Steel Buildings and Bridges" for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.
2. Remove backing bars or runoff tabs, back gouge, and grind steel smooth.
3. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for mill material.
4. Verify that weld sizes, fabrication sequence, and equipment used for architecturally exposed structural steel will limit distortions to allowable tolerances. Prevent weld show-through on exposed steel surfaces.

    a. Grind butt welds flush.
    b. Grind or fill exposed fillet welds to smooth profile. Dress exposed welds.
    c. Re-profile all steel surfaces (using needle guns or other profiling methods) that have been welded and ground smooth to assure proper adhesion of primers and topcoats.

3.05 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified independent testing and inspecting agency to inspect field welds and high-strength bolted connections.

B. Bolted Connections: Bolted connections will be inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts". When using bolted connections prime with “slip critical class B” primer as specified in this Section. All surfaces of bolted or bearing connections may be primed. When welding, hold back primer a minimum of 2 inches each side of weld.

C. Welded Connections: Field welds will be visually inspected according to AWS D1.1. In addition to visual inspection, specialty tests will be performed in accordance with AWS D1.1 and at the frequency stated in Article 1.5.F.5

D. In addition to visual inspection, test and inspect field-welded shear connectors according to requirements in AWS D1.1 for stud welding and as follows:

1. Perform bend tests if visual inspections reveal either a less-than- continuous 360-degree flash or welding repairs to any shear connector.

2. Conduct tests on additional shear connectors if weld fracture occurs on shear connectors already tested, according to requirements in AWS D1.1.

E. Correct deficiencies in Work that test reports and inspections indicate do not comply with the Contract Documents.

3.06 REPAIRS AND PROTECTION

A. Repair damaged galvanized coatings on galvanized items with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Touchup Painting: After installation, promptly clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted joists and accessories, bearing plates, and abutting structural steel.

1. Clean and prepare surfaces by SSPC-SP 3 power-tool cleaning.

2. Apply a compatible primer of same type as shop primer used on adjacent surfaces.

END OF SECTION

SECTION 05210

STEEL JOISTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Applicable requirements of Condition of Contract and General Requirements apply to Work specified in this Section.

B. Work included:

1. Provide open web steel joists, long span steel joists, and bridging.
2. Provide all accessories per SJI requirements.

C. Related work specified elsewhere:

1. Structural Steel Framing: Section 05120
2. Steel Roof Deck: Section 05310

1.02 QUALITY ASSURANCE

A. Steel joist and joist girder manufacturer: Member of SJI.

B. Steel joists: SJI approved.

C. Conform to SJI Standard Specifications, Load Tables and Weight Tables.

1.03 REFERENCES

A. ASTM A325 -- High Strength Bolts for Structural Steel Joints.

B. AWS D1.1 -- Structural Welding Code.

C. SJI -- “Standard Specification for Open Web Steel Joists K--Series”

D. SJI -- “Recommended Code of Standard Practice for Steel Joists and Joist Girders.”

E. AISC -- Manual of Steel Construction.

F. SJI Technical Digest #9 -- “Handling and Erection of Steel Joists and Joist Girders.”

1.04 SUBMITTALS

A. Submit shop drawings under provisions of Section 01300.

B. Indicate standard designations, sizes, spacing and locations of joists, bridging, connections, attachments and top and bottom chord extensions.

C. Design for special joists and joist girders:

1. Special joists shall be designed for the load designations specified on the structural drawings. Designs shall properly account for the distribution of concentrated loads, live loads and for the effect of openings. Designs are to meet requirements of SJI.
2. Joists shall meet the following deflection criteria per SJI. Maximum live load deflection shall not exceed: L/240 for roofs; L/360 for floors where L = span length, center to center of bearing.
3. Designs shall include the net wind uplift loads indicated on the drawings.
4. Provide joist girder bottom chord bracing to meet SJI slenderness ratio criteria. Bracing shall not develop continuity in the joist system unless continuity has been provided for in the joists.

1.05 STORAGE

A. Store materials off ground on wood sleepers.

B. Storage and handling of steel joists to conform to SJI Technical Digest #9.

PART 2 PRODUCTS

2.01 MATERIALS

A. Steel Joists: Meet SJI Standard Specifications. Cold--formed joist chord members are unacceptable.

B. Bolts, Nuts and Washers: ASTM -- A325.

C. Primer: Manufacturer’s standard primer.

2.02 FABRICATION

A. Fabricate steel joists in accordance with the approved shop drawings and SJI Standard Specification.

B. Provide top and bottom joist chord extensions where indicated.

C. Bearing:

1. Provide sloped bearing ends where joist slope exceeds 1/4″ in 12″.
2. Provide bearing lengths per SJI requirements unless greater bearing lengths are shown on the Drawings.

D. Remove loose scale, rust and other foreign materials from fabricated joists and accessories and apply one coat of primer paint per SJI specifications.

PART 3 EXECUTION

3.01 3.01 INSPECTION

A. Verify completed construction will permit and support steel joist and joist girder erection.

B. In the event of discrepancy, immediately notify the Engineer.

C. Do not proceed or install in areas of discrepancy until all such discrepancies have been fully resolved.

3.02 PREPARATION

A. Coordinate placement of anchorages in concrete and masonry construction for securing bearing plates and angles.

3.03 ERECTION

A. Erect steel joists in accordance with the approved shop drawings and SJI Standard Specifications and SJI Technical Digest #9.

B. Bear joists on supports in accordance with SJI.

C. During erection, provide temporary bracing for induced loads and stresses.

D. Field weld joist seats to preset bearing plates and angles after alignment and positioning and after installation of bridging.

1. Welded Joints: Comply with AWS 1.1.
2. Welding Electrodes and Fillets: AISC Specification.

E. Positioning:

1. Erected horizontal sweep shall not exceed L/360.
2. Erected vertical alignment shall not exceed D/48, where D is the joist depth in inches.

F. Do not permit erection of decking until joists are braced and bridged.

G. Do not field cut or alter joists and joist girders without written approval of Engineer.

H. After erection, prime welds, abrasions and surfaces not primed. Use primer consistent with shop coat.

END OF SECTION

SECTION 05310

STEEL ROOF DECK

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Applicable requirements of Condition of Contract and General Requirements apply to Work specified in this Section.

B. Work included:

1. Provide steel roof deck.

C. Related work specified elsewhere:

1. Structural Steel Framing: Section 05120
2. Steel Joists: Section 05210
3. Metal Fabrications: Section 05500 (Bearing plates and angles).

1.02 QUALITY ASSURANCE

A. Metal deck shall be designed in accordance with the latest edition of the Steel Deck Institute's (SDI) -- "Specifications and Commentary for Steel Roof Deck."

B. The roof deck shall be designed, manufactured and installed to meet Factory Mutual Class I construction.

1.03 REFERENCE STANDARDS

A. AISI -- "Specification for the Design of Cold—Formed Steel Structural Members."

B. ASTM A36 -- Structural Steel.

C. ASTM A611 -- Structural Steel, Sheet, Carbon, Cold-Rolled

D. ASTM A653 -- Steel Sheet, Zinc--Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot Dip Process.

E. AWS D1.1 -- Structural Welding Code.

F. AWS D1.3 -- Specification for Welding Sheet Steel in Structures.

G. SDI -- “Design Manual for Composite Decks, Form Decks and Roof Decks.”

H. AISC -- Manual of Steel Construction.

I. SDI -- Diaphragm Design Manual.

1.04 SUBMITTALS

A. Submit Shop Drawings for review of general conformance to design concept in accordance with Section 01300. Erection Drawings shall show type of deck, shop finish, accessories, method of attaching, edge details, deck openings and reinforcement, and sequence of installation.

1.05 STORAGE

A. Store materials off ground with one end elevated on wood sleepers to provide drainage. Protect deck from elements with a waterproof covering and ventilate to avoid condensation.

PART 2 PRODUCTS

2.01 MATERIALS

A. Sheet steel shall conform to ASTM A611 Grade C, D or E (for prime painted decks) and ASTM A653, Structural Quality (for galvanized decks) and have a minimum yield strength of 33,000 psi.

B. Bearing Plates and/or Angles shall be ASTM A36 steel.

C. Welding Methods and Materials shall conform to AWS D1.1 and AWS D1.3.

D. Steel Closure Strips, Ridge and Valley Plates, and Related Accessories shall be a minimum of 22 gage sheet steel of required profiles and sizes.

E. Finish:

1. Shop Primer shall be acrylic medium gray.
2. Touch--up primer shall be compatible with manufacturer’s primer.

F. Mechanical fasteners shall be Teks as manufactured by Buildex, St. Charles Road, Elgin, Illinois, 60120. Selection of Teks fasteners not specified herein shall be in accordance with the manufacturer’s recommendations.

G. Acoustical Insulation shall be glass fiber type with profile to suit decking and be supplied by the deck manufacturer.

2.02 FABRICATION

A. Steel deck shall have formed ribs of the type, finish, dimension and gage as shown on Drawings.

B. Fabricate deck in lengths to have three continuous spans or more whenever possible. Fabricate sheets to lap a minimum of 2″ over supports at ends. Lap joints required where roof pitch changes due to the deck support elevations.

C. Design steel decking in accordance with SDI “Design Manual for Composite Decks, Form Decks, and Roof Decks.” The maximum working stress shall not exceed 20,000 psi. The maximum working stress shall in no case exceed the maximum yield strength of the steel divided by 1.65 but may be increased by 33% for temporary concentrated loads provided the deck thus required is not less than that required for the specific uniform load. The deflection of the Deck under design live load shall not exceed 1/240 of the span. Minimum thickness of material supplied shall be within 5% of the design thickness.

D. Section properties used in determining stress and deflection shall be calculated in accordance with the latest edition of the Steel Deck Institute’s “Design Manual for Floor Decks and Roof Decks”.

E. Fabricate roof sump pan of 14 gage sheet steel, flat bottom, sloped sides, recessed 1-1/2 inches below roof deck surface, bearing flange 3 inches wide, watertight.

F. Provide 6″ closure strip where changes in deck direction occur. Closure shall be same gauge as deck.

PART 3 EXECUTION

3.01 INSTALLATION

A. On steel support members provide 1-1/2″ minimum bearing. Align and level on supports.

B. Fasten steel deck units to structural supports using Hex washer head Teks or arc spot welds according to manufacturers’ specifications and erection layouts and as specified herein. Decks thinner than 0.0280 inches shall be welded using 16 ga. welding washers with a 3/8″ diameter hole. Side lap connections shall be screwed or button punched depending on deck profile.

C. Attach ridge and valley plates and steel cant strips directly to the steel deck where shown on the Drawings to provide a finished surface for the application of insulation and roofing.

D. Cutting of openings through the deck less than 16 square feet in area, and all skew cutting shall be performed in the field.

E. Arc spot welds (puddle welds) to supports shall have a diameter of 5/8″ minimum, or an elongated weld of 3/8″ minimum width and 3/4″ minimum length. Weld metal shall penetrate all layers of deck material at end laps and have adequate fusion to the supporting members. Welding shall be done in accordance with the American Welding Society Standard “Specification for Welding Sheet Steel in Structures”, AWS D1.3.

F. Fastening of deck to supports and side laps.

1. Deck ends at building perimeter: 12″ o/c (36/4 min.)
2. Deck end laps: 12″ o/c (36/4 min.)
3. Deck sides at building perimeter and deck side laps: Deck units with spans greater than five feet shall be fastened at midspan or at 36″ intervals whichever is smaller.
4. See drawings for requirements beyond these minimum requirements.

G. At ends of decks or where changes of deck direction occur, fasten at each flute. Furnish and install adequate closures and fasten to both sides at 18″ o.c.

H. Accessories shall be fastened to supports or deck with mechanical fasteners at not over 6″ o.c. and at all corners and ends.

I. Position roof sump pans with flange bearing on top surface of deck. Screw at each deck flute.

3.02 CLEAN UP AND FINAL ADJUSTMENTS

A. Touch up surface coating damage and abrasions using a paint compatible with primer paint and/or specially formulated for use with galvanized steel.

B. Installation holes shall be sealed with a closure plate 2 gauges thicker than deck and mechanically fastened to deck. Steel deck with holes visible from below will be rejected. Deck units that are bent, warped, or damaged in any way which would impair the strength and appearance of the deck shall be removed from site.

C. Steel decking work and accessories, when complete, shall be solid, smooth, and uniform in appearance.

D. Remove any unused steel deck, edge trimmings, screws, weld washers, butt ends of welding electrodes and other debris from completed installation.

END OF SECTION

SECTION 05400

COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.01 GENERAL PROVISIONS

A. 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.

1.02 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Bearing walls for bar-joists.
2. Bearing walls seated on masonry bond beams.
3. Non-load bearing cold-formed metal framing.

B. Related Work: The following items are not included in this Section and are specified under the designated Sections:

1. Section 05500 - METAL FABRICATIONS for masonry shelf angles and connections.
2. Section 06160 - SHEATHING for exterior sheathing applied to cold-formed metal framing.
3. Section 09211 - GYPSUM BOARD ASSEMBLIES for interior non-loadbearing, metal-stud framing and ceiling-suspension assemblies.

1.03 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design framing, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Structural Performance: Provide cold-formed metal framing capable of withstanding design loads within limits and under conditions indicated.

1. Design Loads: As required by code.

2. Deflection Limits: Design framing systems to withstand design loads within deflections greater than the following:

a. Exterior Non-Load-Bearing Framing:

1) Horizontal deflection of l/240 of the wall height for metal panel systems.
2) Horizontal deflection of 1/600 of the wall height for masonry systems.

b. Interior Load-Bearing Framing: Horizontal deflection of 1/240 of the wall height under a horizontal load of 5 lbf/sq. ft. (239 Pa), unless otherwise indicated on structural drawings.

3. Design framing systems to provide for movement of framing members without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 120 deg F.
4. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load, plus superimposed dead load, deflection of primary building structure.

C. Cold-Formed Steel Framing, General: Design according to AISI's "Standard for Cold-Formed Steel Framing - General Provisions."

1. Design exterior non-load-bearing wall framing to accommodate horizontal deflection without regard for contribution of sheathing materials.

1.04 SUBMITTALS

A. Product Data: For each type of cold-formed metal framing product and accessory indicated.

B. Shop Drawings: Show layout, spacings, sizes, thicknesses, and types of cold-formed metal framing; fabrication; and fastening and anchorage details, including mechanical fasteners. Show reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.

C. Delegated-Design Submittal: For framing 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. Welding certificates.

E. Qualification Data: For professional engineer.

F. Product Test Reports: From a qualified testing agency, unless otherwise stated, indicating that each of the following complies with requirements, based on evaluation of comprehensive tests for current products:

1. Steel sheet.
2. Expansion anchors.
3. Power-actuated anchors.

4. Mechanical fasteners.
5. Vertical deflection clips.
6. Miscellaneous structural clips and accessories.

1.05 QUALITY ASSURANCE

A. Engineering Responsibility: Preparation of Shop Drawings, design calculations, and other structural data by a qualified professional engineer.

B. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in the jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of cold-formed metal framing that are similar to those indicated for this Project in material, design, and extent.

C. Product Tests: Mill certificates or data from a qualified independent testing agency, or in-house testing with calibrated test equipment indicating steel sheet complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements, ductility, and metallic-coating thickness.

D. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code--Steel," and AWS D1.3, "Structural Welding Code--Sheet Steel."

E. AISI Specifications and Standards: Comply with AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members" and its "Standard for Cold-Formed Steel Framing - General Provisions."

1. Comply with AISI's "Standard for Cold-Formed Steel Framing - Truss Design."
2. Comply with AISI's "Standard for Cold-Formed Steel Framing - Header Design."

1.06 DELIVERY, STORAGE, AND HANDLING

A. Protect cold-formed metal framing from corrosion, deformation, and other damage during delivery, storage, and handling.

B. Store cold-formed metal framing, protect with a waterproof covering, and ventilate to avoid condensation.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

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

1. ClarkDietrich Building Systems. https://www.clarkdietrich.com/
2. Consolidated Fabricators Corp.; Building Products Division. http://www.confabbpd.com/
3. MarinoWARE; a division of Ware Industries. https://www.marinoware.com/
4. Super Stud Building Products Inc. https://www.buysuperstud.com/

2.02 MATERIALS

A. Recycled Content of Steel Products: Provide products with an average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.

B. Steel Sheet: ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of grade and coating weight as follows:

1. Grade: As required by structural performance.
2. Coating: G90.

C. Steel Sheet for Vertical Deflection Clips: ASTM A 653/A 653M, structural steel, zinc coated, of grade and coating as follows:

1. Grade: As required by structural performance.
2. Coating: G90 (Z275).

2.03 METAL FRAMING

A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: 0.0538 inch (16 gauge), unless otherwise indicated.

B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: Matching steel studs.
2. Flange Width: 1-1/4 inches.

C. Vertical Deflection Clips: Manufacturer's standard clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.

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

a. ClarkDietrich Building Systems.
b. MarinoWARE, a division of Ware Industries.

c. The Steel Network, Inc.

2.04 FRAMING ACCESSORIES

A. Fabricate steel-framing accessories from steel sheet, ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of same grade and coating weight used for framing members.

B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated.

2.05 ANCHORS, CLIPS, AND FASTENERS

A. Steel Shapes and Clips: ASTM A 36/A 36M, zinc coated by hot-dip process according to ASTM A 123/A 123M.

B. Anchor Bolts: ASTM F 1554, threaded carbon-steel bolts, and carbon-steel nuts; and flat, hardened-steel washers; zinc coated by hot-dip process according to ASTM A 153/A 153M, Class C.

C. Expansion Anchors: Fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 5 times design load, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.

1. Acceptable Manufacturers: Kwik-Bolt 3 by Hilti, Inc., TruBolt Wedge Anchor by ITW Red Head or Power-Stud by Powers Fasteners.

D. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 10 times design load, as determined by testing per ASTM E 1190 conducted by a qualified independent testing agency.

E. Mechanical Fasteners: ASTM C 1513, corrosion-resistant-coated, self-drilling, self-tapping steel drill screws.

1. Head Type: Low-profile head beneath sheathing, manufacturer's standard elsewhere.

F. Welding Electrodes: Comply with AWS standards.

2.06 MISCELLANEOUS MATERIALS

A. Galvanizing Repair Paint: SSPC-Paint 20 or DOD-P-21035 or ASTM A 780.

1. Provide interior, field-applied paint with a VOC content of 250 g/L or less, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Nonmetallic, Nonshrink Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage-compensating agents, and

plasticizing and water-reducing agents, complying with ASTM C 1107, with fluid consistency and 30-minute working time.

C. Shims: Load bearing, high-density multimonomer plastic, nonleaching.

D. Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to match width of bottom track or rim track members.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine supporting substrates and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Before sprayed fire-resistive materials are applied, attach continuous angles, supplementary framing, or tracks to structural members indicated to receive sprayed fire-resistive materials.

B. After applying sprayed fire-resistive materials, remove only as much of these materials as needed to complete installation of cold-formed framing without reducing thickness of fire-resistive materials below that are required to obtain fire-resistance rating indicated. Protect remaining fire-resistive materials from damage.

C. Install sealer gaskets to isolate the underside of wall bottom track or rim track and the top of foundation wall or slab at stud or joist locations.

3.03 INSTALLATION, GENERAL

A. Cold-formed metal framing may be shop or field fabricated for installation, or it may be field assembled.

B. Install cold-formed metal framing according to AISI's "Standard for Cold-Formed Steel Framing - General Provisions" and to manufacturer's written instructions unless more stringent requirements are indicated.

C. Install cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened.

1. Cut framing members by sawing or shearing; do not torch cut.
2. Fasten cold-formed metal framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.

D. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.

E. Install temporary bracing and supports to secure framing and support loads comparable in intensity to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.

F. Do not bridge building expansion and control joints with cold-formed metal framing. Independently frame both sides of joints.

G. Fasten hole reinforcing plate over web penetrations that exceed size of manufacturer's standard punched openings.

H. Erection Tolerances: Install cold-formed metal framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:

1. Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.04 EXTERIOR NON-LOAD-BEARING WALL INSTALLATION

A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure as indicated.

B. Fasten both flanges of studs to top and bottom track, unless otherwise indicated. Space studs as follows:

1. Stud Spacing: 16 inches.

C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.

D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.

E. Install horizontal bridging in wall studs, spaced in rows indicated on Shop Drawings but not more than 48 inches apart. Fasten at each stud intersection.

F. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, fasteners, and stud girts, to provide a complete and stable wall-framing system.

3.05 LOAD-BEARING INSTALLATION

A. Install continuous top and bottom tracks sized to match studs. Align tracks accurately and securely anchor at corners and ends, and at spacings as indicated, or if not indicated, as required to comply with design loads.

B. Squarely seat studs against top and bottom tracks with gap not exceeding of 1/8 inch (3 mm) between the end of wall framing member and the web of track. Fasten both flanges of studs to top and bottom tracks. Space studs as follows:

1. Stud Spacing: As indicated, or if not indicated, as required to comply with design loads

C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar configurations.

D. Align studs vertically where floor framing interrupts wall-framing continuity. Where studs cannot be aligned, continuously reinforce track to transfer loads.

E. Align floor and roof framing over studs according to AISI S200, Section C1. Where framing cannot be aligned, continuously reinforce track to transfer loads.

F. Anchor studs abutting structural columns or walls, including masonry walls, to supporting structure as indicated.

G. Install headers over wall openings wider than stud spacing. Locate headers above openings as indicated. Fabricate headers of compound shapes indicated or required to transfer load to supporting studs, complete with clip-angle connectors, web stiffeners, or gusset plates.

1. Frame wall openings with not less than a double stud at each jamb of frame as indicated on Shop Drawings. Fasten jamb members together to uniformly distribute loads.
2. Install runner tracks and jack studs above and below wall openings. Anchor tracks to jamb studs with clip angles or by welding, and space jack studs same as full-height wall studs.

H. Install supplementary framing, blocking, and bracing in stud framing indicated to support fixtures, equipment, services, casework, heavy trim, furnishings, and similar work requiring attachment to framing.

1. If type of supplementary support is not indicated, comply with stud manufacturer's written recommendations and industry standards in each case, considering weight or load resulting from item supported.

I. Install horizontal bridging in stud system, spaced vertically as indicated on Shop Drawings. Fasten at each stud intersection.

1. Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs with a minimum of two screws into each flange of the clip angle for framing members up to 6 inches (150 mm) deep.
2. Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
3. Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.

J. Install steel sheet diagonal bracing straps to both stud flanges, terminate at and fasten to reinforced top and bottom tracks. Fasten clip-angle connectors to multiple studs at ends of bracing and anchor to structure.

K. Install miscellaneous framing and connections, including supplementary framing, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.06 FIELD QUALITY CONTROL

A. Testing: Engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Field and shop welds will be subject to testing and inspecting.

C. Testing agency will report test results promptly and in writing to Contractor and Engineer.

D. Remove and replace work where test results indicate that it does not comply with specified requirements.

E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.07 REPAIRS AND PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed metal framing with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that cold-formed metal framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION

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SECTION 05500

METAL FABRICATIONS

PART 1 - GENERAL

1.01 GENERAL PROVISIONS

A. 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.

1.02 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following. Requirements for materials, hot-dip galvanizing, and shop-applied primers are included with each item as applicable.

1. Aluminum gratings; includes brackets, supports and clips as applicable.
2. Loose steel bearing and leveling plates, including bearing plates for steel joists, galvanized at exterior locations and in exterior walls.
3. Galvanized steel lintels with shop-applied primer at exterior locations.
4. Steel lintels with shop-applied zinc-rich primer at interior locations.
5. Galvanized shelf angles with shop applied primer at exterior locations.
6. Shelf angles with zinc-rich shop-applied primer at interior locations.
7. Miscellaneous steel framing and supports:
    a. Galvanized steel framing and supports for mechanical and electrical equipment.
    b. Steel framing and supports for applications where framing and supports are not specified in other Sections; galvanized at exterior locations and in exterior walls.
    c. Prefinished slotted steel channel support framing.
8. Galvanized steel bollards with shop-applied primer.
9. Galvanized pipe guards with shop-applied primer.
10. Cast gray iron downspout boots.

B. Related Work: The following items are not included in this Section and are specified under the designated Sections:

1. Section 05120 - STRUCTURAL STEEL FRAMING for structural steel items.
2. Section 09900 - PAINTING AND COATING for field painting work of this section.

C. Items To Be Furnished Only: Furnish the following items for installation by the designated Sections

1. Section 03300 - CAST-IN-PLACE CONCRETE:
    a. Lintels, sleeves, anchors, inserts, plates and similar items.
2. Section 04200 - UNIT MASONRY:
    a. Lintels, miscellaneous metal and iron sleeves, anchors, inserts and plates to be built into masonry walls.

1.03 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design gratings, railings miscellaneous framing and supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Structural Performance of Railings: Provide railings capable of withstanding the effects of gravity loads and Code required loads and stresses within limits and under conditions indicated.

C. Thermal Movements: Provide exterior metal fabrications that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

1.04 SUBMITTALS

A. Product Data: For the following:

1. Paint products.
2. Grout.

B. Shop Drawings: Show fabrication and installation details for metal fabrications.

1. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.
2. Provide templates for anchors and bolts specified for installation under other Sections.
3. Where fabrications are to receive sprayed-on fireproofing, include statement that primer is compatible with fireproofing proposed for use.

C. Delegated-Design Submittal: For installed products 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. Welding certificates.

E. Qualification Data: For professional engineer.

1.05 QUALITY ASSURANCE

A. Engineering Responsibility: Preparation of Shop Drawings, design calculations, and other structural data by a qualified professional engineer.

B. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in the jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of metal fabrications that are similar to those indicated for this Project in material, design, and extent.

C. Welding: Qualify procedures and personnel according to the following:

1. AWS D1.1, "Structural Welding Code--Steel."
2. AWS D1.3, "Structural Welding Code--Sheet Steel."

D. Metal Surfaces, General: Provide materials with smooth, flat surfaces, unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

1.06 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication and indicate measurements on Shop Drawings.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating metal fabrications without field measurements. Coordinate wall and other contiguous construction to ensure that actual dimensions correspond to established dimensions.
2. Provide allowance for trimming and fitting at site.

1.07 COORDINATION

A. Coordinate installation of anchorages for metal fabrications. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

B. Coordinate installation of steel weld plates and angles for casting into concrete that are specified in this Section but required for work of another Section. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.01 METALS

A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

B. Steel Tubing: ASTM A 500, cold-formed steel tubing.

C. Steel Pipe: ASTM A 53/A 53M, standard weight (Schedule 40), unless another weight is indicated or required by structural loads.

1. Provide Schedule 80 pipe for bollards.

D. Slotted Channel Framing: Cold-formed metal channels with continuous slot complying with MFMA-4.

E. Cast Iron: ASTM A 48/A 48M, Class 30, unless another class is indicated or required by structural loads.

F. Aluminum Plate and Sheet: ASTM B 209 (ASTM B 209M), Alloy 6061-T6.

G. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), Alloy 6063-T6.

H. Aluminum-Alloy Rolled Tread Plate: ASTM B 632/B 632M, Alloy 6061-T6.

I. Aluminum Castings: ASTM B 26/B 26M, Alloy 443.0-F.

2.02 FASTENERS

A. General: Unless otherwise indicated, provide Type 316 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 5, at exterior walls. Provide stainless-steel fasteners for fastening aluminum. Select fasteners for type, grade, and class required.

B. Anchor Bolts: ASTM F 1554, Grade 36. Provide hot-dip or mechanically deposited, zinc-coated anchor bolts where item being fastened is indicated to be galvanized.

C. Cast-in-Place Anchors in Concrete: Anchors capable of sustaining, without failure, a load equal to four times the load imposed, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.

1. Threaded or wedge type; galvanized ferrous castings, either ASTM A 47/A 47M malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, hot-dip galvanized per ASTM A 153/A 153M.

D. Expansion Anchors: Anchor bolt and sleeve assembly with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.

1. Acceptable Manufacturers: Kwik-Bolt 3 by Hilti, Inc., TruBolt Wedge Anchor by ITW Red Head or Power-Stud by Powers Fasteners.

E. Slotted-Channel Inserts: Cold-formed, hot-dip galvanized-steel box channels (struts) complying with MFMA-4, 1-5/8 by 7/8 inches by length indicated with anchor straps or studs not less than 3 inches long at not more than 8 inches o.c. Provide with temporary filler and tee-head bolts, complete with washers and nuts, all zinc-plated to comply with ASTM B 633, Class Fe/Zn 5, as needed for fastening to inserts.

2.03 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

B. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.

C. Zinc-Rich Primer: Complying with SSPC-Paint 20 or SSPC-Paint 29 and compatible with topcoat.

1. Provide interior, field-applied primer with a VOC content of 250 g/L or less, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

D. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.

1. Provide interior, field-applied paint with a VOC content of 250 g/L or less, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

F. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

2.04 FABRICATION, GENERAL

A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch, unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

D. Form exposed work true to line and level with accurate angles and surfaces and straight edges.

E. Weld corners and seams continuously to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts, unless otherwise indicated. Locate joints where least conspicuous.

G. Fabricate seams and other connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

2.05 TUBE RAILINGS

A. General: Fabricate railings 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.

B. Welded Connections: 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.

C. Form changes in direction of railings as detailed on the Drawings.

D. 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.

E. Close exposed ends of railing members with prefabricated end fittings.

F. 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 or less.

G. 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.

1. Connect posts to stair framing by direct welding, unless otherwise indicated.
2. For galvanized railings, provide galvanized fittings, brackets, fasteners, sleeves, and other ferrous-metal components.
3. For nongalvanized railings, provide nongalvanized ferrous-metal fittings, brackets, fasteners, and sleeves, except galvanize anchors embedded in exterior masonry and concrete construction.

H. Fillers: Provide fillers made from plate, or other suitably crush-resistant material, where needed to transfer wall bracket loads through wall finishes to structural supports. Size fillers to suit wall finish thicknesses and to produce adequate bearing area to prevent bracket rotation and overstressing of substrate.

2.06 LOOSE BEARING AND LEVELING PLATES

A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.

2.07 LOOSE STEEL LINTELS

A. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated. Weld adjoining members together to form a single unit where indicated.

B. Size loose lintels to provide bearing length at each side of openings equal to 1/12 of clear span but not less than 8 inches, unless otherwise indicated.

2.08 SHELF ANGLES

A. Fabricate shelf angles from steel angles of sizes indicated and for attachment to concrete framing. Provide horizontally slotted holes to receive 3/4-inchbolts, spaced not more than 6 inches from ends and 24 inches o.c., unless otherwise indicated.

1. Provide mitered and welded units at corners.
2. Provide open joints in shelf angles at expansion and control joints. Make open joint approximately 2 inches larger than expansion or control joint.

B. For cavity walls, provide vertical channel brackets to support angles from backup masonry and concrete.

C. Furnish wedge-type concrete inserts, complete with fasteners, to attach shelf angles to cast-in-place concrete.

2.09 GRATINGS

A. Fabricate to comply with NAAMM MBG 531, "Metal Bar Grating Manual."
   1. Grating shall be ADA compliant with an 11 space profile.
   2. Includes brackets, supports and clips as applicable.
   3. The grating shall be swage locked together.

2.10 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide framing and supports not specified in other Sections as needed to complete the Work.

B. Fabricate units from shapes, plates, and bars of welded construction, unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction retained by framing and supports. Cut, drill, and tap units to receive hardware, hangers, and similar items.

   1. Fabricate units from slotted channel framing where indicated.
   2. Furnish inserts if units are installed after concrete is placed.

2.11 STEEL WELD PLATES AND ANGLES

A. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with not less than two integrally welded steel strap anchors for embedding in concrete.

2.12 MISCELLANEOUS TRIM

A. Unless otherwise indicated, fabricate units from shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.

B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.

   1. Provide with integrally welded steel strap anchors for embedding in concrete or masonry construction.

2.13 METAL BOLLARDS

A. Fabricate metal bollards from Schedule 80 steel pipe, hot-dip galvanized.

B. Fabricate bollards with welded metal cap, and in accordance with Drawings.

C. Provide concrete for placing bollards. Comply with requirements of Division 03 - Concrete, and details indicated on drawings.

2.14 PIPE GUARDS

A. Fabricate pipe guards from 3/8-inch-thick by 12-inch--wide steel plate, bent to fit flat against the wall or column at both ends and to fit around pipe with 2-inch clearance between pipe and pipe guard. Drill each end for two 3/4-inch anchor bolts.

2.15 METAL DOWNSPOUT BOOTS

A. Provide downspout boots made from cast gray iron in heights indicated with inlets of size and shape to suit downspouts.

2.16 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish metal fabrications after assembly.

2.17 ALUMINUM FINISHES

A. As-Fabricated Finish: AA-M12.

2.18 STEEL PRIMERS AND FINISHES

A. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed metal fabrications:

1. Exteriors (SSPC Zone 1B) and Items Indicated to Receive Zinc-Rich Urethane Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
2. Interiors (SSPC Zone 1A): SSPC-SP 7, "Brush Off Blast Cleaning."
3. Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finishes and those to be field welded, embedded in concrete or masonry, unless otherwise indicated. Extend priming of partially embedded members to a depth of 2 inches.
4. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.
5. Comply with SSPC-PA 2, "Measurement of Dry Coating Thickness with magnetic Gages."

B. Zinc-Rich Primer: Urethane zinc rich primer compatible with topcoat Specified in Section 09900 - PAINTS AND COATINGS. Provide primer with a VOC content of 340 g/L (2.8 lb/gal.) or less per OTC and HAPS COMPLIANT STANDARDS PER 2007 standards when calculated according to 40 CFR 59, Subpart D (EPA Method 24). Provide Tnemec Series 394 Perimerprime at 3.0 mils DFT or approved equal by DuPont or Carboline.

1. Provide interior, field-applied primer with a VOC content of 250 g/L or less, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.19 HOT-DIP GALVANIZING

A. 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: Duragalv by Duncan Galvanizing.
2. Comply with ASTM A 123 for fabricated products and ASTM A 153 for hardware.
3. Provide thickness of galvanizing specified in referenced standards.
4. Galvanizing bath shall contain special high grade zinc and other earthly materials.
5. Fill vent holes after galvanizing, if applicable, and grind smooth.

2.20 HOT-DIP GALVANIZING AND FACTORY-APPLIED PRIMER

A. 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: Duragalv by Duncan Galvanizing.
2. Comply with ASTM A 123 for fabricated products and ASTM A 153 for hardware.
3. Provide thickness of galvanizing specified in referenced standards.
4. Galvanizing bath shall contain special high grade zinc and other earthly materials.
5. Fill vent holes after galvanizing, if applicable, and grind smooth.

B. Factory-Applied Primer over Galvanized Steel: Provide factory-applied prime coat, certified OTC/VOC compliant less than 2.8 lbs/gal. and conforming to EPA and local requirements. Apply primer within 12 hours after galvanizing at the same galvanizer's plant in a controlled environment meeting applicable environmental regulations and as recommended by the primer coating manufacturer. Primer coat shall exhibit a rugosity (smoothness) not greater than 4 rug (16-20 microns of variation) when measured by a profilometer over a 1 inch straight line on the surface of architectural and structural elements that are less than 24 pounds per running foot. Profilometer shall be capable of operating in 1 micron increments. Blast cleaning of the surface is unacceptable for surface preparation. Primer shall have a minimum two year re-coat window for application of finish coat. Coatings must meet or exceed the following performance criteria as stipulated by the coatings manufacturer:

1. Basis-of-Design: Primergalv by Duncan Galvanizing.
2. Abrasion Resistance: ASTM D 4060 (CS17 Wheel, 1,000 grams load).1kg load, 200 mg loss.
3. Adhesion: ASTM D4541, 1050 psi.
4. Corrosion Weathering: ASTM D5894, 13 cycles, 4,368 hours; rating 10 per ASTM D714 for blistering and rating 7 per ASTM D610 for rusting.

5. Direct Impact Resistance: ASTM D2794, 160 in. lbs.
6. Flexibility: Method: ASTM D522, 180 degree bend, 1 inch mandrel, passes.
7. Pencil Hardness: ASTM D3363, 3B.
8. Moisture Condensation Resistance: ASTM D4585, 100 degrees F, 2000 hours; passes, no cracking or delamination.
9. Dry Heat Resistance: Method: ASTM D2485, 250 degrees F.
10. Warranty: Provide galvanizer's warranty that materials will be free from 10 percent or more visible rust for a period of 20 years.

PART 3 - EXECUTION

3.01 INSTALLATION, GENERAL

A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

C. Field Welding: Comply with the following requirements:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag bolts, wood screws, and other connectors.

E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

F. Corrosion Protection: Coat concealed surfaces of steel and aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals with a heavy coat of bituminous paint.

3.02 INSTALLING BEARING AND LEVELING PLATES

A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.

B. 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.

1. 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.
2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.
3. The bearing bar shape shall be rectangular with smooth top surface.

3.03 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.

3.04 INSTALLING PIPE BOLLARDS

A. Anchor bollards in place with concrete footings. Center and align bollards in holes 3 inches above bottom of excavation. Place concrete and vibrate or tamp for consolidation. Support and brace bollards in position until concrete has cured.

3.05 INSTALLING PIPE GUARDS

A. Provide pipe guards at exposed vertical pipes in parking garage where not protected by curbs or other barriers. Install by bolting to wall or column with expansion anchors. Provide four 3/4-inch bolts at each pipe guard. Mount pipe guards with top edge 26 inches above driving surface.

3.06 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

B. Touch-Up and Repair for Galvanized Surfaces: For damaged and field-welded metal coated surfaces, clean welds, bolted connections and abraded areas.

1. For galvanized surfaces, apply organic zinc repair paint complying with requirements of ASTM A 780, modified to 95 percent zinc in dry film. Galvanizing repair paint shall have 95 percent zinc by weight, ZiRP by Duncan Galvanizing. Thickness of applied galvanizing repair paint shall be not less than coating thickness required by ASTM A 123 or A 153 as applicable. Touch-up of galvanized surfaces with silver paint, brite paint, or aluminum paints is not acceptable.
2. For factory-applied finish coatings, field-touch-up shall be performed by factory approved personnel for warranties to apply. Touch-up shall be such that repair is not visible from a distance of 6 feet. If non factory-approved technicians are used for field touch-up, no warranties shall exist.
3. A touch-up repair kit or touchup instructions shall be provided to the Owner for each type of factory-applied finish.

END OF SECTION

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DIVISION 06

SECTION 06100

ROUGH CARPENTRY

PART 1 - GENERAL

1.01 GENERAL PROVISIONS

A. 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.

1.02 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Wood blocking, cants, and nailers.
2. Plywood backing panels.

B. Related Work: The following items are not included in this Section and are specified under the designated Sections:

1. Section 04200 - UNIT MASONRY for wood nailers and blocking built into masonry.
2. Section 06160 - SHEATHING for plywood sheathing.
3. Section 06402 - INTERIOR ARCHITECTURAL WOODWORK for interior woodwork not specified in this Section.
4. Section 09211 - GYPSUM BOARD ASSEMBLIES for sheet metal backing.

1.03 SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used, net amount of preservative retained, and chemical treatment manufacturer's written instructions for handling, storing, installing, and finishing treated material.
2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials, both before and after exposure to elevated temperatures when tested according to ASTM D 5516 and ASTM D 5664.

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

1.04 QUALITY ASSURANCE

A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Stack lumber, plywood, and other panels; place spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.01 WOOD PRODUCTS, GENERAL

A. Lumber: DOC PS 20 and applicable rules of lumber grading agencies certified by the American Lumber Standards Committee Board of Review.

1. Factory mark each piece of lumber with grade stamp of grading agency.
2. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.
3. Provide dressed lumber, S4S, unless otherwise indicated.
4. Provide dry lumber with 15 percent maximum moisture content at time of dressing for 2-inch nominal thickness or less, unless otherwise indicated.

B. Plywood Panels:

1. Plywood: Either DOC PS 1 or DOC PS 2, unless otherwise indicated.
2. Thickness: As needed to comply with requirements specified but not less than thickness indicated.
3. Factory mark panels according to indicated standard.

2.02 WOOD-PRESERVATIVE-TREATED MATERIALS

A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2 for interior construction not in contact with the ground, Use Category UC3b for exterior construction not in contact with the ground, and Use Category UC4a for items in contact with the ground.

1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium. Do not use inorganic boron (SBX) for sill plates.
2. For exposed items indicated to receive a stained or natural finish, use chemical formulations that do not require incising, contain colorants, bleed through, or otherwise adversely affect finishes.

B. Kiln-dry material after treatment to a maximum moisture content of 19 percent for lumber and 15 percent for plywood. Do not use material that is warped or does not comply with requirements for untreated material.

C. Mark each treated item with the treatment quality mark of an inspection agency approved by the American Lumber Standards Committee Board of Review.

D. Application: Treat items indicated on Drawings, and the following:

1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
2. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete in exterior walls.

2.03 FIRE-RETARDANT-TREATED MATERIALS

A. General: For all interior use materials, provide materials that are fire-retardant treated and comply with performance requirements in AWPA C20 (lumber) and AWPA C27 (plywood). Identify fire-retardant-treated wood with appropriate classification marking of UL, U.S. Testing, Timber Products Inspection, or another testing and inspecting agency acceptable to authorities having jurisdiction.

1. Use treatment for which chemical manufacturer publishes physical properties of treated wood after exposure to elevated temperatures, when tested by a qualified independent testing agency according to ASTM D 5664, for lumber and ASTM D 5516, for plywood.
2. Use treatment that does not promote corrosion of metal fasteners.

2.04 MISCELLANEOUS LUMBER

A. General: Provide lumber for support or attachment of other construction, including the following:

1. Rooftop equipment bases and support curbs.
2. Blocking.
3. Cants.
4. Nailers.
5. Furring.
6. Grounds.

B. For items of dimension lumber size, provide Construction, Stud, or No. 2 grade lumber with 15 percent moisture content.

2.05 PANEL PRODUCTS

A. Miscellaneous Concealed Plywood: Exposure 1 sheathing, span rating to suit framing in each location, and thickness as indicated but not less than 1/2 inch.

B. Telephone and Electrical Equipment Backing Panels: DOC PS 1, Exposure 1, C-D Plugged, fire-retardant treated, in thickness indicated or, if not indicated, not less than 1/2 inch thick.

2.06 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.

1. Where carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners of Type 304 stainless steel.

B. Nails, Wire, Brads, and Staples: FS FF-N-105.

C. Power-Driven Fasteners: CABO NER-272.

D. Wood Screws: ASME B18.6.1.

E. Screws for Fastening to Cold-Formed Metal Framing: ASTM C 954, except with wafer heads and reamer wings, length as recommended by screw manufacturer for material being fastened.

F. 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 6 times the load imposed when installed in unit masonry assemblies and equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.

1. Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5; except provide Type 304 stainless steel where in contact with pressure-preservative treated wood.

2.07 MISCELLANEOUS MATERIALS

A. Adhesive, Including 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).

PART 3 - EXECUTION

3.01 INSTALLATION, GENERAL

A. Discard units of material with defects that impair quality of carpentry and that are too small to use with minimum number of joints or optimum joint arrangement.

B. Set carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit carpentry to other construction; scribe and cope as needed for accurate fit. Locate furring, nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.

C. Apply field treatment complying with AWPA M4 to cut surfaces of preservative-treated lumber and plywood.

D. Securely attach carpentry work as indicated and according to applicable codes and recognized standards.

E. Countersink fastener heads on exposed carpentry work and fill holes with wood filler.

F. Use fasteners of appropriate type and length. Predrill members when necessary to avoid splitting wood.

3.02 WOOD BLOCKING, AND NAILER INSTALLATION

A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.

B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces, unless otherwise indicated.

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SECTION 06160

SHEATHING

PART 1 - GENERAL

1.01 GENERAL PROVISIONS

A. 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.

1.02 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Plywood sheathing for the following conditions and as indicated:
   a. Attached to cold-formed metal framing members at exterior wall.
   b. Substrate at eave, rake, ridge fascias, and belt course assembly.
   c. Attached to metal deck.
2. Composite nail base insulated fire-retardant treated roof sheathing.

B. Related Work: The following items are not included in this Section and are specified under the designated Sections:

1. Section 05400 - COLD-FORMED METAL FRAMING for metal framing at exterior wall.
2. Section 06100 - ROUGH CARPENTRY for miscellaneous rough carpentry.
3. Section 07620 - SHEET METAL FLASHING AND TRIM for flashing applied to roof sheathing.
4. Section 07210 – THERMAL INSULATION for rigid insulation at the roof.

1.03 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 fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Include physical properties of treated materials.
2. For fire-retardant treatments, 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.

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

B. Evaluation Reports: For following products, from ICC-ES:

1. Fire-retardant-treated plywood.
2. Foam-plastic sheathing.

1.04 QUALITY ASSURANCE

A. Source Limitations: Obtain each type sheathing product through one source from a single manufacturer.

B. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant-treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

C. Fire-Resistance-Rated Assemblies: Where sheathing boards are part of fire-resistance-rated assemblies, provide assemblies as follows:

1. Assemblies comply with requirements of fire-response-tested assemblies indicated by GA File Numbers in GA-600, "Fire Resistance Design Manual"; or by design designations in UL's "Fire Resistance Directory" or in certification listings of another testing and inspecting agency acceptable to authorities having jurisdiction.
2. Fire-resistance ratings were determined by fire-response testing assemblies according to ASTM E 119.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original packages, containers, or bundles, each bearing brand name and identification of manufacturer.

B. Store materials protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, or other causes. Neatly stack sheathing board flat on leveled supports off the ground, under cover, and fully protected from weather.

1. Neatly stack sheathing boards flat on leveled supports off the ground, under cover, and fully protected from weather.

1.06 SEQUENCING AND SCHEDULING

A. Sequence installing sheathing with installing roofing to comply with requirements indicated below:

1. Do not leave sheathing board exposed to weather.

PART 2 - PRODUCTS

2.01 GYPSUM SHEATHING

A. Glass-Mat Gypsum Sheathing Board: ASTM C 1177.

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

a. CertainTeed Corp.; GlasRoc.
b. Georgia-Pacific Gypsum LLC; Dens-Glass Gold.
c. National Gypsum Company; Gold Bond, e^2XP.
d. USG Corporation; Securock.

2. Type and Thickness: 5/8 inch, Type X.

B. Screws for Fastening Gypsum Sheathing: 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.

2.02 WOOD PANEL PRODUCTS

A. Plywood: Either DOC PS 1 or DOC PS 2, unless otherwise indicated.

B. Thickness: As needed to comply with requirements specified, but not less than thickness indicated.

C. Factory mark panels to indicate compliance with applicable standard.

2.03 FIRE-RETARDANT-TREATED PLYWOOD

A. General: Where fire-retardant-treated materials are indicated, use materials complying with requirements in this article that are acceptable to authorities having jurisdiction and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.

B. Fire-Retardant-Treated Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E 84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes,

and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.

1. Use treatment that does not promote corrosion of metal fasteners.
2. Exterior and Interior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated plywood by pressure process after being subjected to accelerated weathering according to ASTM D 2898. Use for exterior locations and where indicated.
3. Design Value Adjustment Factors: Treated lumber plywood shall be tested according ASTM D 5516 and design value adjustment factors shall be calculated according to ASTM D 6305. Span ratings after treatment shall be not less than span ratings specified.

C. Kiln-dry material after treatment to a maximum moisture content of 15 percent. Do not use material that is warped or does not comply with requirements for untreated material.

D. Identify fire-retardant-treated plywood with appropriate classification marking of qualified testing agency.

E. Application: Treat plywood indicated on Drawings, and the following:

1. Roof and wall sheathing material.

2.04 PLYWOOD SHEATHING

A. Plywood Sheathing for Wall and Other Indicated Conditions: Exterior, Structural I sheathing.

1. Span Rating: As indicated on Structural Drawings.
2. Nominal Thickness: 5/8 inch.
3. Edges: Square.

B. Plywood Sheathing for Roof: Exterior, Structural I sheathing.

1. Span Rating: As indicated on Structural Drawings.
2. Nominal Thickness: 1/2 inch.
3. Edges: Tongue and groove.

2.05 COMPOSITE NAIL BASE INSULATED ROOF SHEATHING

A. Plywood: 5/8 inch, APA-rated exterior plywood.

B. Vented, Plywood-Surfaced, Polyisocyanurate-Foam Sheathing: Rigid, cellular, polyisocyanurate thermal insulation complying with ASTM C 1289, Type II, Class 1, with plywood adhered to spacers on one face.

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

    a. Atlas Roofing Corporation.
    b. Cornell Corporation.
    c. Dow Chemical Company (The).
    d. Hunter Panels.
    e. Johns Manville; Berkshire Hathaway Inc.
    f. Rmax, Inc.

2. Polyisocyanurate-Foam Thickness: As indicated on Drawings.
3. Spacers: Wood furring strips or blocks, spaced not more than 16 inches o.c.
    a. Thickness: As indicated.

2.06 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.

1. Material: Type 304 stainless steel.

B. Screws for Fastening Plywood-Surfaced, Polyisocyanurate-Foam Sheathing to Metal Roof Deck: Steel drill screws, in type and length recommended by sheathing manufacturer for thickness of sheathing 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. Provide washers or plates if recommended by sheathing manufacturer.

2.07 VAPOR RETARDER

A. Loose-Laid Sheet Vapor Retarder: Minimum 10 mil polyethylene sheet with maximum permeance rating of 0.1 perm.

1. Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.

PART 3 - EXECUTION

3.01 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. Arrange joints so that pieces do not span between fewer than three support members.

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."

D. Coordinate sheathing installation with flashing and joint sealant installation so these materials are installed in the sequence and manner that prevent exterior moisture from passing through completed assembly.

E. Do not bridge building expansion joints with sheathing; cut and space edges to match spacing of structural support elements.

F. 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.

3.02 WOOD STRUCTURAL PANEL INSTALLATION

A. General: Comply with applicable recommendations in APA Form No. E30, "Engineered Wood Construction Guide," for types of structural-use panels and applications indicated.

B. Fastening Methods: Fasten panels as indicated below:

1. Wall Sheathing:

a. Fasten to framing. Apply a continuous bead of glue to framing members at edges of wall sheathing panels.
b. Space panels 1/8 inch apart at edges and ends.

3.03 GYPSUM SHEATHING INSTALLATION

A. General: Install gypsum sheathing to comply with GA-253 and manufacturer's written instructions.

B. Cut boards at penetrations, edges, and other obstructions of the work; fit tightly against abutting construction, except provide a 3/8-inch setback where non-load-bearing construction abuts structural elements and a 1/4-inch gap where they abut masonry or similar materials that might retain moisture, to prevent wicking.

C. Coordinate sheathing installation with flashing and joint sealant installation so these materials are installed in the sequence and manner that prevent exterior moisture from passing through completed exterior wall assembly.

D. Apply fasteners so screw heads bear tightly against face of sheathing boards but do not cut into facing.

E. Do not bridge building expansion joints with sheathing; cut and space edges to match spacing of structural support elements.

F. Vertical Installation: Install 48-inch- wide gypsum sheathing boards vertically with vertical edges centered over flanges of steel studs. Abut ends and edges of each board with those of adjacent boards. Screw-attach boards at perimeter and within field of board to each steel stud:

1. Perimeter: 6 inches on center.
2. Field: 8 inches on center.

3.04 COMPOSITE NAIL BASE INSTALLATION

A. Installation of Composite Insulation/Nailbase Panels for Roofing

1. Panels shall be laid out so that joints are supported by framing or blocking and that installation is within flatness tolerances for roofing.
2. Fasten panels to substrate using fasteners recommended by manufacturer of panels, spaced as required to meet performance criteria specified in this Section.

3.05 VAPOR-RETARDER INSTALLATION

A. Polyethylene Film Vapor Retarder: Loosely lay polyethylene-film vapor retarder over area to receive vapor retarder, side, and end lapping each sheet a minimum of 2 inches and 6 inches, respectively. Continuously seal side and end laps with tape.

B. Completely seal vapor retarder at side laps, end laps, terminations, obstructions, and penetrations to prevent air movement into roofing system.

END OF SECTION

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SECTION 06402

INTERIOR ARCHITECTURAL WOODWORK

PART 1 - GENERAL

1.01 GENERAL PROVISIONS

A. 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.

1.02 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
   1. Plastic-laminate window sills.
   2. Paint grade trim and casings at windows, including paint grade wood jamb extensions at windows.
   3. Closet and utility shelving.
   4. Paint grade wall baseboard at perimeter of WC walls (coord. with flooring).

B. Related Work: The following items are not included in this Section and are specified under the designated Sections:

   1. Section 06100 - ROUGH CARPENTRY for wood furring, blocking, shims, and hanging strips required for installing woodwork and concealed within other construction before woodwork installation.
   2. Section 09900 - PAINTING for field applied finishes on wood.

1.03 SUBMITTALS

A. Product Data: For each type of product specified, including casework hardware and accessories, and finishing materials and processes.

   1. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements.

B. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.

   1. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
      a. Provide schedule of blocking required to support the Work of this Section.
   2. Show locations and sizes of cutouts and holes for plumbing fixtures, electrical components and other items installed in architectural woodwork.

C. Samples for Verification:
   1. Plastic laminates, 8 by 10 inches for each type, color, pattern, and surface finish, with 1 sample applied to core material, and specified edge material applied to 1 edge.

1.04 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.

B. Source Limitations: Engage a qualified woodworking firm to assume undivided responsibility for production of interior architectural woodwork with blueprint-matched wood veneers and components.

C. Quality Standard: Unless otherwise indicated, comply with AWI/AWMAC/WI's "Architectural Woodwork Standards," latest edition, including errata, for grades of interior architectural woodwork indicated for construction, finishes, installation, and other requirements.

D. Fire-Test-Response Characteristics: Where fire-retardant materials or products are indicated, provide materials and products with specified fire-test-response characteristics as determined by testing identical products per test method indicated by UL, ITS, or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify with appropriate markings of applicable testing and inspecting agency in the form of separable paper label or, where required by authorities having jurisdiction, imprint on surfaces of materials that will be concealed from view after installation.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver woodwork until painting and similar operations that could damage woodwork have been completed in installation areas. If woodwork must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Project Conditions" Article.

1.06 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install woodwork until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

   1. The HVAC systems as specified elsewhere may not provide for humidity controls. The expected ranges of relative humidity are expected to be as high as 55% to a low of uncontrolled during the heating system. Comply with AWS Section 2, Care and Storage.

B. Field Measurements: Where woodwork is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Locate concealed framing, blocking, and reinforcements that support woodwork by field measurements before being enclosed, and indicate measurements on Shop Drawings.
2. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating woodwork without field measurements. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.07 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that interior architectural woodwork can be supported and installed as indicated.

PART 2 - PRODUCTS

2.01 PLASTIC-LAMINATE CASEWORK

A. Grade: Custom.

B. AWI Type of Casework Construction: Flush overlay.

C. Laminate Cladding for Exposed Surfaces: High-pressure decorative laminate complying with the following requirements:

1. Horizontal Surfaces Other Than Tops: Grade HGS.
2. Postformed Surfaces: Grade HGP.
3. Vertical Surfaces: Grade HGS.
4. Edges: Grade HGS.

D. Materials for Semiexposed Surfaces:

1. Surfaces Other Than Drawer Bodies: High-pressure decorative laminate, Grade VGS.

a. Edges of Plastic-Laminate Shelves: PVC tape, 0.018-inch minimum thickness, matching laminate in color, pattern, and finish.
b. For semiexposed backs of panels with exposed plastic-laminate surfaces, provide surface of high-pressure decorative laminate, Grade VGS.

2. Drawer Sides and Backs: Solid-hardwood lumber.

3. Drawer Bottoms: Hardwood plywood.

E. Concealed Backs of Panels with Exposed Plastic Laminate Surfaces: High-pressure decorative laminate, Grade BKL.

F. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:

1. As selected by Engineer from laminate manufacturer's full range.

2.02 PLASTIC-LAMINATE COUNTERTOPS AND WINDOW STOOLS

A. Grade: Custom.

B. High-Pressure Decorative Laminate Grade: HGS.

C. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:

1. As selected by Engineer from manufacturer's full range.

D. Edge Treatment: As indicated.

E. Core Material: Exterior-grade plywood.

F. Backer Sheet: Provide plastic-laminate backer sheet, Grade BKL, on underside of countertop substrate.

2.03 INTERIOR FRAMES AND JAMBS FOR OPAQUE FINISH

A. Grade: Custom.

B. Wood Species: Any closed-grain hardwood.

C. Shop Priming: Shop apply the prime coat including backpriming, if any, for opaque-finished items specified to be field finished. Refer to Section 099000 - PAINTING AND COATING for material and application requirements.

2.04 CLOSET AND UTILITY SHELVING

A. Grade: Custom.

B. Shelf Material: 1-inch plastic laminate-faced panel product with solid-lumber edge.

C. Cleats: 3/4-inch solid lumber.

D. Standards for Adjustable Shelf Brackets: BHMA A156.9, B04102; powder-coat-finished steel.

E. Adjustable Shelf Brackets: BHMA A156.9, B04112; powder-coat-finished steel.

F. Clothes Rods: 1-5/16-inch-diameter, chrome-plated-steel tubes.

1. Rod Flanges: Chrome-plated steel.

2.05 SHOP FINISHING

A. General: Comply with AWI/AWMAC/WI's "Architectural Woodwork Standards" for factory finishing.

1. Finish architectural woodwork at fabrication shop as specified in this Section. Defer only final touchup, cleaning, and polishing until after installation.

B. Preparation for Finishing: Comply with referenced quality standard for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing architectural woodwork, as applicable to each unit of work.

1. Backpriming: Apply one coat of sealer or primer, compatible with finish coats, to concealed surfaces of woodwork. Apply two coats to back of paneling and to end-grain surfaces. Concealed surfaces of plastic-laminate-clad woodwork do not require backpriming when surfaced with plastic laminate, backing paper, or thermoset decorative panels.

2.06 MATERIALS

A. General: Provide materials that comply with requirements of AWI/AWMAC/WI's "Architectural Woodwork Standards" for each type of woodwork and quality grade specified, unless otherwise indicated.

B. Wood Species for Opaque Finish: Any closed-grain hardwood.

C. Wood Products: Comply with the following:
1. Hardboard: AHA A135.4.
2. Medium-Density Fiberboard (MDF): ANSI A208.2, Grade MD, made with binder containing no added urea formaldehyde.
3. Particleboard: ANSI A208.1, Grade M-2-Exterior Glue.
4. Softwood Plywood: DOC PS 1, Medium Density Overlay (MDO).
5. Veneer-Faced Panel Products (Hardwood Plywood): HPVA HP-1, made with adhesive containing no added urea formaldehyde.
a. Resin impregnated paper backs are not permitted. Backs shall be of compatible hardwood species and cut. Contact adhesive is not permitted.

D. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or, if not indicated, as required by woodwork quality standard.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering high-pressure decorative laminates that may be incorporated into the Work include, but are not limited to, the following:
    a. Arborite; Division of ITW Canada, Inc.
    b. Formica Corporation.
    c. Lamin-Art, Inc.
    d. Nevamar Company; a division of Panolam Industries.
    e. Wilsonart International; Div. of Premark International, Inc.

2.07 FIRE-RETARDANT-TREATED MATERIALS

A. General: Where fire-retardant-treated materials are indicated, use materials complying with requirements in this Article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified.

1. Do not use treated materials that do not comply with requirements of referenced woodworking standard or that are warped, discolored, or otherwise defective.
2. Use fire-retardant-treatment formulations that do not bleed through or otherwise adversely affect finishes. Do not use colorants to distinguish treated materials from untreated materials.
3. Identify fire-retardant-treated materials with appropriate classification marking of UL, U.S. Testing, Timber Products Inspection, or another testing and inspecting agency acceptable to authorities having jurisdiction.

B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Comply with performance requirements of AWPA C20 (lumber) and AWPA C27 (plywood). Use the following treatment type:

1. Exterior Type: Organic-resin-based formulation thermally set in wood by kiln drying.
2. Mill lumber before treatment and implement special procedures during treatment and drying processes that prevent lumber from warping and developing discolorations from drying sticks or other causes, marring, and other defects affecting appearance of treated woodwork.
3. Kiln-dry materials before and after treatment to levels required for untreated materials.

C. Fire-Retardant Particleboard: Panels complying with the following requirements, made from softwood particles and fire-retardant chemicals mixed together at time of panel manufacture to achieve flame-spread index of 25 or less and smoke-developed index of 25 or less per ASTM E 84.

1. Fire-Retardant Fiberboard and Particleboard: Provide five ply construction with crossbands to prevent any ammonia fuming from the core to the face veneers.

2.08 CASEWORK HARDWARE AND ACCESSORIES

A. General: Provide casework hardware and accessory materials associated with architectural casework, except for items specified in Section 08710 - DOOR HARDWARE.

B. Frameless Concealed Hinges (European Type): BHMA A156.9, B01602,100 degrees of opening, self-closing.

C. Wire Pulls: Satin stainless steel 4 inch wire pulls.

D. Catches: Push-in magnetic catches, BHMA A156.9, B03131.

E. Adjustable Shelf Standards and Supports: BHMA A156.9, B04071; with shelf rests, B04081 or BHMA A156.9, B04102; with shelf brackets, B04112.

F. Drawer Slides: BHMA A156.9, B05091; side mounted and extending under bottom edge of drawer; full-extension type; epoxy-coated-steel with steel ball-bearings; of the following grades:

1. Box Drawer Slides: Grade 1.
2. File Drawer Slides: Grade 1HD-100.
3. Pencil Drawer Slides: Grade 2.
4. Keyboard Slides: Grade 1.
5. Trash Bin Slides: Grade 1HD-100.

G. Door Locks: BHMA A156.11, E07121.

H. Drawer Locks: BHMA A156.11, E07041.

I. Grommets for Cable Passage through Countertops: Molded-plastic grommets and matching plastic caps with slot for wire passage.

J. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.

1. Satin Stainless Steel: BHMA 630.
2. Satin Aluminum, Clear Anodized: BHMA 628.

K. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.

2.09 MISCELLANEOUS MATERIALS

A. Furring, Blocking, Shims, and Hanging Strips: Fire-retardant-treated softwood lumber, kiln dried to less than 15 percent moisture content.

B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide nonferrous-metal or hot-dip galvanized anchors and inserts on

inside face of exterior walls and elsewhere as required for corrosion resistance. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.

C. Adhesives, General: Do not use adhesives that contain urea formaldehyde.

D. VOC Limits for Installation Adhesives and Glues: Use installation adhesives that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

1. Wood Glues: 30 g/L.
2. Contact Adhesives: Not permitted on the Project without Engineer's prior approval.

2.10 FABRICATION, GENERAL

A. Wood Moisture Content: Comply with requirements of referenced quality standard for wood moisture content in relation to ambient relative humidity during fabrication and in installation areas.

B. Sand fire-retardant-treated wood lightly to remove raised grain on exposed surfaces before fabrication.

C. Fabricate woodwork to dimensions, profiles, and details indicated. Ease edges to radius indicated for the following:

1. Corners of Casework and Edges of Solid-Wood (Lumber) Members and Rails: 1/16 inch.

D. Complete fabrication, including assembly, finishing, and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

E. Shop-cut openings to maximum extent possible to receive hardware, appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

1. Seal edges of openings in countertops with a coat of varnish.

PART 3 - EXECUTION

3.01 PREPARATION

A. Before installation, condition woodwork to average prevailing humidity conditions in installation areas.

B. Before installing architectural woodwork, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming.

3.02 INSTALLATION

A. Grade: Install woodwork to comply with requirements for the same grade specified in Part 2 for fabrication of type of woodwork involved.

B. Assemble woodwork and complete fabrication at Project site to comply with requirements for fabrication in Part 2, to extent that it was not completed in the shop.

C. Install woodwork level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb (including tops) to a tolerance of 1/8 inch in 96 inches.

D. Scribe and cut woodwork to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

E. Fire-Retardant-Treated Wood: Handle, store, and install fire-retardant-treated wood to comply with chemical treatment manufacturer's written instructions, including those for adhesives used to install woodwork.

F. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing as required for complete installation. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork and matching final finish if transparent finish is indicated.

G. Casework: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.

1. Install casework with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.

H. Countertops and Window Stools: Anchor securely by screwing through corner blocks of base casework or other supports into underside of countertop.

1. Align adjacent solid-surfacing-material countertops and form seams to comply with manufacturer's written recommendations using adhesive in color to match countertop. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
2. Install countertops with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
3. Secure backsplashes to tops with concealed metal brackets at 16 inches and to walls with adhesive.
4. Caulk space between backsplash and wall with sealant specified in Section 07920 - JOINT SEALANTS.

I. Touch up finishing work specified in this Section after installation of woodwork. Fill nail holes with matching filler where exposed.

3.03 ADJUSTING AND CLEANING

A. Repair damaged and defective woodwork, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.

B. Clean, lubricate, and adjust hardware.

C. Clean woodwork on exposed and semiexposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

END OF SECTION

DIVISION 07

SECTION 07210

THERMAL INSULATION

PART 1 - GENERAL

1.01 GENERAL PROVISIONS

A. 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.

1.02 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Rigid extruded polystyrene insulation at roofing.
2. Mineral wool cavity wall insulation where indicated.
3. Spray foam insulation at gaps.

B. Related Work: The following items are not included in this Section and are specified under the designated Sections:

1. Section 06160 – SHEATHING for insulated roofing sheathing.
2. Section 07270 - AIR BARRIERS for air and vapor barrier membrane.
3. Section 09211 - GYPSUM BOARD ASSEMBLIES for acoustic insulation in gypsum board assemblies.
4. Division 15 - PLUMBING for plumbing insulation.
5. Division 15 - HEATING, VENTILATING, AND AIR CONDITIONING for mechanical insulation.

1.03 SUBMITTALS

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

1.04 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of building insulation through one source from a single manufacturer.

B. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Protect insulation materials from physical damage and from deterioration by moisture, soiling, and other sources. Store in a dry and secure location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

B. Protect plastic insulation as follows:

1. Do not expose to sunlight, except to extent necessary for period of installation and concealment.
2. Protect against ignition at all times. Do not deliver materials to Project site before installation time.
3. Complete installation and concealment of materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.01 EXTRUDED POLYSTYRENE INSULATION (INS-1)

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. DiversiFoam Products.
2. Dow Chemical Company.
3. Owens Corning.
4. Carlisle Syntec Systems.
5. GAF Commercial Roofing Products.
6. Firestone Building Products Company, LLC.

B. Board Insulation: Extruded-polystyrene board insulation complying with ASTM C 578, square edged of type, density, and compressive strength indicated below:

1. For vertical applications, Type IV, 1.6-lb/cu. ft. minimum density and 25-psi minimum compressive strength.
2. For horizontal and sloped applications, Type V, 3-lb/cu. ft. minimum density and 100-psi minimum compressive strength.

C. Adhesive for Bonding Insulation: Product with demonstrated capability to bond insulation securely to substrates indicated without damaging insulation and substrates.

2.02 CAVITY WALL INSULATION, MINERAL-WOOL BOARD (INS-2)

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. Thermafiber, Owens Corning.
2. Rockwool Inc.
3. Fibrex Insulations Inc.
4. Isolatek International.

B. Unfaced, Mineral-Wool Board Insulation: ASTM C 612, Type IVB; with maximum flame-spread and smoke-developed indexes of 15 and zero, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics. Declare Label preferred.

1. Nominal density of 4 lb/cu. ft. Types IA and IB, thermal resistivity of 4 deg F x h x sq. ft./Btu x in. at 75 deg F minimum.
2. Fiber Color: Natural, except darkened where visible through joints in cladding.
3. NFPA 285 Assembly Fire Propagation Characteristics Testing Results: Passing.

C. Attachment to Substrate, Masonry Veneers: Manufacturer's recommended mechanical attachment clip or disk.

D. Attachment to Substrate, Panel Veneers: Manufacturer's recommended adhesively attached, spindle-type insulation anchors.

2.03 SPRAYED-FOAM INSULATION AT GAPS (INS-3)

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

1. Canam Building Envelope Specialists; Zerodraft Z1-24 Foam Sealant.
2. Dow Chemical; GreatStuff Pro.
3. Foam-Tech Div. of H.C. Fennell; SuperGreen Foam.
4. Todol Products; Pur Fill 1G.

B. Sprayed-Foam Insulation: Water-cure closed cell polyurethane containing no urea-formaldehyde and no CFCs.

1. Minimum density of 0.4 lb/cu. ft., thermal resistivity of 3.4 deg F x h x sq. ft./Btu x in. at 75 deg F.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements of Sections in which substrates and related work are specified and for other conditions affecting performance.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

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

3.03 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products and application indicated.

B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed at any time to ice, rain, and snow.

C. Extend insulation in thickness indicated to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

D. Miscellaneous Voids: Install spray polyurethane foam insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation.

3.04 INSTALLATION OF BELOW-GRADE INSULATION

A. On vertical surfaces, set rigid insulation units in adhesive applied according to manufacturer's written instructions. Use adhesive recommended by insulation manufacturer.

1. If not otherwise indicated, extend insulation a minimum of 60 inches below exterior grade line.

B. On horizontal surfaces, loosely lay rigid insulation units according to manufacturer's written instructions. Stagger end joints and tightly abut insulation units.

3.05 INSTALLATION OF CAVITY-WALL INSULATION

A. Install mineral wool board cavity insulation per manufacturer’s instructions. Fit insulation with edges butted tightly in both directions. Do not compress insulation. Maintain cavity width of dimension indicated between insulation and cladding material.

1. Masonry Veneers: Secure with clips installed over masonry anchors. Provide at least 6 clips per mineral wool board.
2. Panel Veneers: Secure with adhesively attached, spindle-type insulation anchors. Space anchors according to insulation manufacturer's written instructions.

3.06 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified independent testing and inspecting agency to perform field tests and inspections indicated below and prepare test reports.

B. Infrared Camera Survey: Perform an infrared camera scan of walls, floors, and ceilings to determine where insulation and air barrier are not continuous, after insulation has been installed, but prior to plaster patching or new gypsum board installation.

1. Provide complete digital report with images of test results with recommendations for repairs.

C. Repair or replace work where test results and inspections indicate that it does not comply with specified requirements.

D. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.07 PROTECTION

A. Protect installed insulation and vapor retarders from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION

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SECTION 07270

AIR BARRIERS

PART 1 - GENERAL

1.01 GENERAL PROVISIONS

A. 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.

1.02 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Self-adhering, vapor-retarding, modified bituminous sheet air barrier
2. Transition strips to adjacent and penetrating materials.

B. Related Work: The following items are not included in this Section and are specified under the designated Sections:

1. Section 04210 – ARCHITECTURAL FACE BRICK for brick installed outboard of air and vapor barrier system.
2. Section 06160 - SHEATHING for sheathing substrate for air and vapor barrier system.

1.03 DEFINITIONS

A. Air Barrier Assembly: The collection of air barrier materials and auxiliary materials applied to an opaque wall or soffit, including joints and junctions to abutting construction, to control air movement through the wall.

1.04 PERFORMANCE REQUIREMENTS

A. General: Air barrier shall be capable of performing as a continuous vapor-retarding air barrier and as a liquid-water drainage plane flashed to discharge to the exterior incidental condensation or water penetration. Air barrier assemblies shall be capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, penetrations, and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.

B. Air Barrier Assembly Air Leakage: Not to exceed 0.03 cfm/sq. ft. of surface area at 1.57 lbf/sq. ft., ASTM E 2357.

C. Fire Test Performance: Passes NFPA 285, Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components.

1.05 PRECONSTRUCTION TESTING

A. Mockup Testing: Air barrier assemblies shall comply with performance requirements indicated, as evidenced by reports based on mockup testing by a qualified testing agency.

1. In addition to the Contractor testing as specified herein below in Part 3, the Owner may engage a qualified testing agency.
2. Quantitative Air Leakage Testing: Testing of the mockup for air leakage will be conducted not to exceed the test pressure differential, positive and negative, indicated in "Performance Requirements" Article for air barrier assembly air leakage when tested according to ASTM E 783.
3. Notify Engineer and the Owner a minimum of seven days in advance of the dates and times when mockup testing will take place.

1.06 SUBMITTALS

A. Product Data: Include manufacturer's written instructions for evaluating, preparing, and treating substrate; technical data; and tested physical and performance properties of air barrier.

B. Shop Drawings: Show locations and extent of air barrier. Include details for substrate joints and cracks, counterflashing strip, penetrations, inside and outside corners, terminations, and tie-ins with adjoining construction.

1. Include details of interfaces with other materials that form part of air barrier.
2. Include details of mockups.

C. Product Certificates: For air barriers, certifying compatibility of air barrier and accessory materials with Project materials that connect to or that come in contact with air barrier; signed by product manufacturer.

D. Air Barrier Certification: Submit manufacturer’s certification that air barrier, as designed in the assemblies indicated on the Drawings, has been tested to meet the requirements of NFPA 285 and passed.

E. Qualification Data: For Applicator.

F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for air barriers.

1.07 QUALITY ASSURANCE

A. Applicator Qualifications: A firm experienced in applying air barrier materials similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance.

B. Mockups: Before beginning installation of air barrier, build mockups of exterior wall assembly 150 sq. ft., incorporating backup wall construction, external cladding, window, door frame and sill, insulation, and flashing to demonstrate surface preparation, crack and joint treatment, and sealing of gaps, terminations, and penetrations of air barrier membrane.

1. Coordinate construction of mockup to permit inspection by Owner's testing agency of air barrier before external insulation and cladding is installed.
2. Include junction with roofing membrane, building corner condition, and foundation wall intersection.
3. If the Engineer determines mockups do not comply with requirements, reconstruct mockups and apply air barrier until mockups are approved.
4. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

C. Preinstallation Conference: Conduct conference at Project site.

1. Include installers of other construction connecting to air barrier, such as roofing, waterproofing, architectural precast concrete, masonry, joint sealants, windows, glazed curtain walls, and door frames.
2. Review air barrier requirements including surface preparation, substrate condition and pretreatment, minimum substrate curing period, forecasted weather conditions, special details and sheet flashings, mockups, installation procedures, sequence of installation, testing and inspecting procedures, and protection and repairs.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Store liquid materials in their original undamaged packages in a clean, dry, protected location and within temperature range required by air barrier manufacturer.

B. Remove and replace liquid materials that cannot be applied within their stated shelf life.

C. Store rolls according to manufacturer's written instructions.

D. Protect stored materials from direct sunlight.

1.09 PROJECT CONDITIONS

A. Environmental Limitations: Apply air barrier within the range of ambient and substrate temperatures recommended by air barrier manufacturer. Protect substrates from

environmental conditions that affect performance of air barrier. Do not apply air barrier to a damp or wet substrate or during snow, rain, fog, or mist.

PART 2 - PRODUCTS

2.01 SELF-ADHERING SHEET AIR BARRIER

A. Sheet-Applied, Vapor-Retarding Modified Bituminous Sheet: 40-mil-thick, self-adhering sheet consisting of 36 mils of rubberized asphalt laminated to a 4-mil-thick, cross-laminated polyethylene film with release liner on adhesive side and formulated for application with primer that complies with VOC limits of 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:

    a. Carlisle Coatings & Waterproofing; CCW-705.
    b. Grace, W. R. & Co.; Perm-A-Barrier.
    c. Henry Company; Blueskin SA.
    d. Meadows, W. R., Inc.; SealTight Air-Shield.
    e. Rubber Polymer Corporation; Rub-R-Wall SA.
    f. Tremco, Inc.; ExoAir 110.
    g. Or approved equal.

2. Physical and Performance Properties:

    a. Membrane Air Permeance: Not to exceed 0.004 cfm/sq. ft. of surface area at 1.57-lbf/sq. ft. pressure difference; ASTM E 2178.
    b. Tensile Strength: 250 psi minimum; ASTM D 412, Die C, modified.
    c. Ultimate Elongation: 200 percent minimum; ASTM D 412, Die C, modified.
    d. Low-Temperature Flexibility: Pass at minus 20 deg F, ASTM D 1970.
    e. Crack Cycling: Unaffected after 100 cycles of 1/8-inch movement; ASTM C 836.
    f. Puncture Resistance: 40 lbf minimum; ASTM E 154.
    g. Water Absorption: 0.15 percent weight-gain maximum after 48-hour immersion at 70 deg F; ASTM D 570.
    h. Vapor Permeance: 0.05 perms, ASTM E 96, Water Method.

2.02 AUXILIARY MATERIALS

A. General: Auxiliary materials recommended by air barrier manufacturer for intended use and compatible with air barrier. Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.

B. Primer: Liquid waterborne or solvent-borne primer recommended for substrate by manufacturer of air barrier material.

C. Counterflashing Strip: Modified bituminous 40-mil-thick, self-adhering sheet consisting of 32 mils of rubberized asphalt laminated to an 8-mil-thick, crosslaminated polyethylene film with release liner backing.

D. Butyl Strip at Termination with EPDM or TPO Roofing Membrane: Vapor-retarding, 30- to 40-mil-thick, self adhering; polyethylene-film-reinforced top surface laminated to layer of butyl adhesive, with release liner backing.

E. Modified Bituminous Strip To Cover Cracks and Joints and Terminate Air Barrier to Compatible Roofing Membrane: Vapor-retarding, 40-mil-thick, smooth-surfaced, self-adhering; consisting of 36 mils of rubberized asphalt laminated to a 4-mil- polyethylene film with release liner backing.

F. Termination Mastic: Cold fluid-applied elastomeric liquid; trowel grade.

G. Substrate Patching Membrane: Manufacturer's standard trowel-grade substrate filler.

H. Adhesive and Tape: Air barrier manufacturer's standard adhesive and pressure-sensitive adhesive tape.

I. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304, 0.0187 inch thick, and Series 300 stainless-steel fasteners.

J. Sprayed Polyurethane Foam Sealant to Fill Gaps at Penetrations and Openings: 1- or 2-component, foamed-in-place, polyurethane foam sealant, 1.5 to 2.0 lb/cu. ft. density; flame spread index of 25 or less according to ASTM E 162; with primer and noncorrosive substrate cleaner recommended by foam sealant manufacturer.

K. Modified Bituminous Transition Strip to Seal Air Barrier Terminations with Glazing Systems: Vapor-retarding, 40-mil-thick, smooth-surfaced, self-adhering; consisting of 36 mils of rubberized asphalt laminated to a 4-mil-thick polyethylene or aluminum film with release liner backing.

L. Preformed Silicone-Sealant Extrusion to Seal Air Barrier Terminations with Glazing Systems: Manufacturer's standard system consisting of cured low-modulus silicone extrusion, sized to fit opening widths, with a single-component, neutral-curing, Class 100/50 (low-modulus) silicone sealant for bonding extrusions to substrates.

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

    a. Dow Corning Corporation, 123 Silicone Seal.
    b. GE Silicone, UltraSpan US1100.
    c. Pecora Corporation, Sil-Span.
    d. Tremco, Incorporated, Spectrem EZ Simple Seal.
    e. Or approved equal.

M. Joint Sealant: ASTM C 920, single-component, neutral-curing silicone; Class 100/50 (low-modulus), Grade NS, Use NT related to exposure, and, as applicable to joint substrates indicated, Use O. Comply with Section 07920 - JOINT SEALANTS.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance.

1. Verify that substrates are sound and free of oil, grease, dirt, excess mortar, or other contaminants.
2. Verify that concrete has cured and aged for minimum time period recommended by air barrier manufacturer.
3. Verify that concrete is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263.
4. Verify that masonry joints are flush and completely filled with mortar.
5. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 SURFACE PREPARATION

A. Clean, prepare, and treat substrate according to manufacturer's written instructions. Provide clean, dust-free, and dry substrate for air barrier application.

B. Mask off adjoining surfaces not covered by air barrier to prevent spillage and overspray affecting other construction.

C. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.

D. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids in concrete with substrate-patching membrane.

E. Remove excess mortar from masonry ties, shelf angles, and other obstructions.

F. Prepare, fill, prime, and treat joints and cracks in substrates. Remove dust and dirt from joints and cracks according to ASTM D 4258.

1. Install modified bituminous strips and center over treated construction and contraction joints and cracks exceeding a width of 1/16 inch.

G. Bridge and cover isolation joints expansion joints and discontinuous deck-to-wall and deck-to-deck joints with overlapping modified bituminous strips.

H. At changes in substrate plane, apply sealant or termination mastic beads at sharp corners and edges to form a smooth transition from one plane to another.

I. Cover gaps in substrate plane and form a smooth transition from one substrate plane to another with stainless-steel sheet mechanically fastened to structural framing to provide continuous support for air barrier.

3.03 TRANSITION STRIP INSTALLATION

A. Install strips, transition strips, and auxiliary materials according to air barrier manufacturer's written instructions to form a seal with adjacent construction and maintain a continuous air barrier.

1. Coordinate the installation of air barrier with installation of roofing membrane and base flashing to ensure continuity of air barrier with roofing membrane.
2. Install butyl or modified bituminous strip on roofing membrane or base flashing so that a minimum of 3 inches of coverage is achieved over both substrates.

B. Apply primer to substrates at required rate and allow to dry. Limit priming to areas that will be covered by air barrier sheet in same day. Reprime areas exposed for more than 24 hours.

1. Prime glass-fiber-surfaced gypsum sheathing with number of prime coats needed to achieve required bond, with adequate drying time between coats.

C. Connect and seal exterior wall air barrier membrane continuously to roofing membrane 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.

D. At end of each working day, seal top edge of strips and transition strips to substrate with termination mastic.

E. Apply joint sealants forming part of air barrier assembly within manufacturer's recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.

F. Wall Openings: Prime concealed perimeter frame surfaces of windows, curtain walls, storefronts, and doors. Apply [modified bituminous transition strip] [adhesive-coated transition strip] [elastomeric flashing sheet] [preformed silicone-sealant extrusion] so that a minimum of 3 inches of coverage is achieved over both substrates. Maintain 3 inches of full contact over firm bearing to perimeter frames with not less than 1 inch of full contact.

1. Transition Strip: Roll firmly to enhance adhesion.
2. Elastomeric Flashing Sheet: Apply adhesive to wall, frame, and flashing sheet. Install flashing sheet and termination bars, fastened at 6 inches o.c. Apply lap sealant over exposed edges and on cavity side of flashing sheet.
3. Preformed Silicone-Sealant Extrusion: Set in full bed of silicone sealant applied to walls, frame, and membrane.

G. Fill gaps in perimeter frame surfaces of windows, curtain walls, storefronts, and doors, and miscellaneous penetrations of air barrier membrane with foam sealant.

H. Seal strips and transition strips around masonry reinforcing or ties and penetrations with termination mastic.

I. Seal top of through-wall flashings to air barrier with an additional 6-inch-wide, modified bituminous strip.

J. Seal exposed edges of strips at seams, cuts, penetrations, and terminations not concealed by metal counterflashings or ending in reglets with termination mastic.

K. Repair punctures, voids, and deficient lapped seams in strips and transition strips. Slit and flatten fishmouths and blisters. Patch with transition strips extending 6 inches beyond repaired areas in strip direction.

3.04 INSTALLATION OF SELF-ADHERING SHEET MEMBRANE

A. Install modified bituminous sheets according to air barrier manufacturer's written instructions and according to recommendations in ASTM D 6135.

1. When ambient and substrate temperatures range between 25 and 40 deg F, install self-adhering, modified bituminous air barrier sheets produced for low-temperature application. Do not use low-temperature sheets if ambient or substrate temperature is higher than 60 deg F.

B. Corners: Prepare, prime, and treat inside and outside corners according to ASTM D 6135.

1. Install modified bituminous strips centered over vertical inside corners. Install 3/4-inch fillets of termination mastic on horizontal inside corners.

C. Prepare, treat, and seal vertical and horizontal surfaces at terminations and penetrations with termination mastic and according to ASTM D 6135.

D. Apply primer to substrates at required rate and allow to dry. Limit priming to areas that will be covered by air barrier sheet in same day. Reprime areas exposed for more than 24 hours.

1. Prime glass-fiber-surfaced gypsum sheathing with number of prime coats needed to achieve required bond, with adequate drying time between coats.

E. Apply and firmly adhere modified bituminous sheets horizontally or vertically over area to receive air barrier sheets. Accurately align sheets and maintain a uniform 2-1/2-inch-minimum lap widths and end laps. Overlap and seal seams and stagger end laps to ensure airtight installation.

1. Apply sheets in a shingled manner to shed water without interception by any exposed sheet edges.
2. Roll sheets firmly to enhance adhesion to substrate.
3. Apply termination mastic on any horizontal, field-cut or non-factory edges.

F. Apply continuous modified bituminous sheets over modified bituminous strips bridging substrate cracks, construction, and contraction joints.

G. Seal top of non-metallic through-wall flashings to air barrier sheet with an additional 6-inch- wide strip.

H. Seal exposed edges of metallic sheets at seams, cuts, penetrations, and terminations not concealed by metal counterflashings or ending in reglets with termination mastic.

I. Install air barrier sheets and auxiliary materials to form a seal with adjacent construction and to maintain a continuous air barrier.

1. Coordinate the installation of air barrier with installation of roofing membrane and base flashing to ensure continuity of air barrier with roofing membrane.
2. Install compatible strip on roofing membrane or base flashing so that a minimum of 3 inches of coverage is achieved over both substrates.

J. Connect and seal exterior wall air barrier membrane continuously to 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.

K. Wall Openings: Prime concealed perimeter frame surfaces of windows, curtain walls, storefronts, and doors. Apply membrane specified below so that a minimum of 3 inches of coverage is achieved over both substrates. Maintain 3 inches of full contact over firm bearing to perimeter frames with not less than 1 inch of full contact.

1. Modified Bituminous Transition Strip: Roll firmly to enhance adhesion.
2. Elastomeric Flashing Sheet: Apply adhesive to wall, frame, and flashing sheet. Install flashing sheet and termination bars, fastened at 6 inches o.c. Apply lap sealant over exposed edges and on cavity side of flashing sheet.
3. Preformed Silicone-Sealant Extrusion: Set in full bed of silicone sealant applied to walls, frame, and membrane.

L. Fill gaps in perimeter frame surfaces of windows, curtain walls, storefronts, doors, and miscellaneous penetrations of air barrier membrane with foam sealant.

M. At end or each working day, seal top edge of membrane to substrate with termination mastic.

N. Apply joint sealants forming part of air barrier assembly within manufacturer's recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.

O. Repair punctures, voids, and deficient lapped seams in air barrier. Slit and flatten fishmouths and blisters. Patch with air barrier sheet extending 6 inches beyond repaired areas in all directions.

P. Do not cover air barrier until it has been tested and inspected by Owner's testing agency.

Q. Correct deficiencies in or remove air barrier that does not comply with requirements; repair substrates and reapply air barrier components.

3.05 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections and prepare test reports.

B. Inspections: Air barrier materials and installation are subject to inspection for compliance with requirements. Inspections may include the following:

1. Continuity of air barrier system has been achieved throughout the building envelope with no gaps or holes.
2. Continuous structural support of air barrier system has been provided.
3. Masonry and concrete surfaces are smooth, clean, and free of cavities, protrusions, and mortar droppings.
4. Site conditions for application temperature and dryness of substrates have been maintained.
5. Maximum exposure time of materials to UV deterioration has not been exceeded.
6. Surfaces have been primed.
7. Laps in sheet materials have complied with the minimum requirements and have been shingled in the correct direction (or mastic applied on exposed edges), with no fishmouths.
8. Termination mastic has been applied on cut edges.
9. Air barrier has been firmly adhered to substrate.
10. Compatible materials have been used.
11. Transitions at changes in direction and structural support at gaps have been provided.
12. Connections between assemblies (membrane and sealants) have complied with requirements for cleanliness, preparation, and priming of surfaces, structural support, integrity, and continuity of seal.
13. All penetrations have been sealed.

C. Tests:

1. Qualitative Testing: Air barrier assemblies will be tested for evidence of air leakage according to ASTM E 1186.

2. Quantitative Air Leakage Testing: Testing not to exceed the test pressure differential, positive and negative, indicated in "Performance Requirements" Article for air barrier assembly air leakage according to ASTM E 783.

D. Remove and replace deficient air barrier components and retest as specified above.

3.06 CLEANING AND PROTECTION

A. Protect air barrier system from damage during application and remainder of construction period, according to manufacturer's written instructions.

1. Protect air barrier from exposure to UV light and harmful weather exposure as required by manufacturer. Remove and replace air barrier exposed to these conditions for more than 30 days.
2. Protect air barrier from contact with creosote, uncured coal-tar products, TPO, EPDM, flexible PVC membranes, and sealants not approved by air barrier manufacturer.

B. Clean spills, stains, and soiling from adjacent construction that would be exposed in the completed work using cleaning agents and procedures recommended by manufacturer of affected construction.

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SECTION 07545
TPO THERMOPLASTIC SINGLE-PLY ROOFING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Thermoplastic Single-Ply Roofing.

B. Roof Insulation, if to be provided by Roof membrane manufacturer.

1.2 RELATED SECTIONS

A. Section 06100 - Rough Carpentry: Roof blocking installation and requirements.

B. Section 07620 - Sheet Metal Flashing and Trim: Metal flashing and counter flashing installation and requirements, gutters, downspouts and roof drains.

1.3 REFERENCES

A. Factory Mutual (FM Global) - Approval Guide.
   1. Factory Mutual Standard 4470 - Approval Standard for Class 1 Roof Covers.

B. Underwriters Laboratories (UL) - Roofing Systems and Materials Guide (TGFU R1306).

C. American Society for Testing and Materials (ASTM) - Annual Book of ASTM Standards.
   1. ASTM C 208 - Standard Specification for Cellulosic Fiber Insulating Board.
   2. ASTM C 578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation.
   3. ASTM C 728 - Standard Specification for Perlite Thermal Insulation Board.
   4. ASTM C 1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board.
   5. ASTM D 41 - Standard Specification for Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing.
   6. ASTM D 312 - Standard Specification for Asphalt Used in Roofing.
   7. ASTM D 1079 - Standard Terminology Relating to Roofing, Waterproofing, and Bituminous Materials.
   8. ASTM D 4263 - Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method.
   9. ASTM D-751 - Standard Test Methods for Coated Fabrics.
   10. ASTM D-2137 - Standard Test Methods for Rubber Property-Brittleness Point of Flexible Polymers and Coated Fabrics.
   11. ASTM E-96 - Standard Test Methods for Water Vapor Transmission of Materials.
   12. ASTM D1204 - Standard Test Method for Linear Dimensional Changes of Nonrigid Thermoplastic Sheeting or Film at Elevated Temperature.
   13. ASTM D-471 - Standard Test Method for Rubber Property-Effect of Liquids.
   14. ASTM D-1149 - Standard Test Methods for Rubber Deterioration-Cracking in an Ozone Controlled Environment.
   15. ASTM G155 - Standard Practice For Operating Xenon Arc Light Apparatus For Exposure Of Non-Metallic Materials.
   16. ASTM D573 - Standard Test Method for Rubber - Deterioration in an Air.

D. Factory Mutual (FM Global) - Approval Guide.

E. Underwriters Laboratories (UL) - Roofing Systems and Materials Guide (TGFU R1306).

F. ENERGYSTAR.

G. Cool Roof Rating Council (CRRC).

H. Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA) - Architectural Sheet Metal.

I. National Roofing Contractors Association (NRCA).

J. American Society of Civil Engineers (ASCE).
   1. ASCE 7 - Minimum Design Loads for Buildings and Other Structures.

1.4 DEFINITIONS

A. Roofing Terminology: Refer to ASTM D1079 and the glossary of the National Roofing Contractors Association (NRCA) Roofing and Waterproofing Manual for definitions of roofing terms related to this section.

1.5 PERFORMANCE REQUIREMENTS

A. Provide an installed roofing membrane and base flashing system that does not permit the passage of water, and will withstand the design pressures calculated in accordance with the most current revision of ASCE 7.

B. Manufacturer shall provide all primary roofing materials that are physically and chemically compatible when installed in accordance with manufacturers current application requirements.

1.6 SUBMITTALS

A. Submit under provisions of Section 01300 - Administrative Requirements.

B. Product Data sheets for each type of product indicated in this section.

C. Shop Drawings: Provide manufacturers standard details and approved shop drawings for the roof system specified.

D. Samples: Provide samples of insulations, fasteners, membrane materials and accessories for verification of quality.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer shall provide a roofing system that meets or exceeds all criteria listed in this section.

B. Installer Minimum Qualifications:
   1. Installer shall be certified and authorized by selected manufacturer.

C. Source Limitations: Components listed shall be provided by a single manufacturer or approved by the primary roofing manufacturer.

D. Final Inspection: Manufacturer's representative shall provide a comprehensive final inspection after completion of the roof system. All application errors shall be addressed and final punch list completed.

1.8 PRE-INSTALLATION CONFERENCE

A. Prior to scheduled commencement of the roofing installation and associated work, conduct a meeting at the project site with the installer, architect, owner, Roof Manufacturer representative and any other persons directly involved with the performance of the work. The installer shall record conference discussions to include decisions, agreements, and open issues and furnish copies of recorded discussions to each attending party. The primary purpose of the meeting is to review foreseeable methods and procedures related to roofing work.

1.9 REGULATORY REQUIREMENTS

A. Work shall be performed in a safe, professional manner, conforming to federal, state and local codes.

B. Exterior Fire Test Exposure: Provide a roofing system achieving a UL Class rating for roof slopes indicated.
   1. UL Class A rating.

C. Windstorm Classification: Provide a roofing system which will achieve the following Factory Mutual wind uplift rating, as listed in the current FM Approval Guide.
   1. Factory Mutual 1-75.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Deliver roofing materials to the site in original containers, with factory seals intact. Products shall carry approved manufacturer’s label.

B. Store pail goods in their original undamaged containers in a clean, dry location within their specified temperature range.

C. Do not expose materials to moisture in any form before, during, or after delivery to the site. Reject delivery of materials that show evidence of contact with moisture.

D. Remove manufacturer supplied plastic covers from materials provided with such. Use "breathable" type covers such as canvas tarpaulins to allow venting and protection from weather and moisture. Cover and protect materials at the end of each work day. Do not remove any protective tarpaulins until immediately before the material will be installed.

E. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.11 PROJECT CONDITIONS

A. Weather:
   1. Proceed with roofing only when existing and forecasted weather conditions permit.
   2. Ambient temperatures shall be above 45 degrees F (7.2 degrees C) when applying hot asphalt or water based adhesives.

1.12 WARRANTY

A. Provide manufacturer's standard Guarantee with single source coverage and no monetary limitation where the manufacturer agrees to repair or replace components in the roofing system, which cause a leak due to a failure in materials or workmanship.
   1. Duration: Thirty (30) years from the date of completion.

B. Provide manufacturer's standard WeatherStopper Integrated Roofing System Guarantee where the manufacturer agrees to repair or replace the portion of the roofing materials, which have resulted in a leak due to a manufacturing defect or defects caused by ordinary wear and tear.
   1. Duration: Twenty (20) years from the date of completion.

C. Provide Puncture Resistance Limited Warranty for the original building owner, that the TPO roof membrane will provide puncture and tear resistance when installed and maintained in accordance with manufacturer's requirements.

D. Provide manufacturer's standard prorated material warranty where the manufacturer agrees to repair or replace to portion of the roofing materials that have resulted in a leak due to a manufacturing defect or defects caused by ordinary wear and tear.
   1. Duration: 30 Years.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers:
   1. Basis of Design: GAF Commercial Roofing Products, 1 Campus Dr.; Parsippany, NJ 07054; Tel: 800-ROOF-411; Tel: 973-628-3000; Email: (TechnicalQuestionsGAF@gaf.com); Web: https://www.gaf.com
   2. Firestone Building Products Company, LLC. 250 West 96th St, Indianapolis, IN 46260 Technical: 1-800-428-4511 www.firestonebpco.com .
   3. Carlisle Syntec Systems P.O. Box 7000 Carlisle, PA 17013 ph: 800-479-6832, www.carlislesyntec.com.

B. Requests for substitutions will be considered in accordance with provisions of Section 01600 - Product Requirements.

2.2 ROOF BOARD

A. Overlayment board with a water-resistant and silicone treated gypsum core with glass fiber facers embedded on both sides, and pre-primed on one side. Basis of Design: GP Dens-Deck Prime Roof Board or as required by roof manufacturer warranty.
   1. Board Thickness: ½"

2.3 MEMBRANE MATERIALS

A. Advanced heat and UV protected, smooth type, polyester scrim reinforced thermoplastic polyolefin membrane with a nominal 0.080 inch (80 mil) thickness, for use as a single ply roofing membrane. UL Listed, FM Approved, CRRC rated and Title 24 compliant. A full roll contains approximately 1000 sq.ft. of roofing material at 10 feet X 100 feet, weighing 433 lbs or 800 sq ft. of roofing material at 8 feet x 100 feet, weighting 347 lbs. A half sheet roll contains approximately 500 sq.ft. of roofing material at 5 feet X 100 feet, weighing 227 lbs or 400 sq.ft of roofing material, weighting 173 lbs. Basis of Design: EverGuard Extreme TPO - 80 mil thermoplastic single-ply roofing membrane, or equal.

1. Color: Gray.

2.4 FLASHING MATERIALS

A. Advanced heat and UV protected, fleece-backed, polyester scrim reinforced thermoplastic polyolefin membrane with a nominal 0.070 inch (70 mil) thickness, for use as a single ply roofing membrane. UL Listed, FM Approved, CRRC rated and Title 24 compliant. Each full roll contains approximately 500 sq.ft. of roofing material, 10 feet X 50 feet, weighing 189 lbs. Each half sheet roll contains approximately 250 sq.ft. of roofing material, 5 feet X 50 feet, weighing 94.5 lbs. Basis of Design: EverGuard Extreme TPO FB Ultra - 70 mil thermoplastic single-ply roofing membrane, or equal.
1. Color: Gray.

2.5 BITUMEN

A. Asphalt bitumen: ASTM D 312 Type III & IV.

2.6 ADHESIVES, SEALANTS AND PRIMERS

A. Low VOC solvent-based Bonding Adhesive: Solvent based rubberized adhesive for use with Basis of Design EverGuard TPO membranes, EverGuard Low VOC Bonding Adhesive, or equal.

B. Low VOC solvent-based liquid, required to protect field cut edges of TPO membranes. Applied directly from a squeeze bottle, Basis of Design: EverGuard Low VOC Cut Edge Sealant, or equal.

C. Low VOC solvent based primer for preparing surfaces to receive butyl based adhesive tapes, Basis of Design: EverGuard TPO Low VOC Primer, or equal.

D. Low VOC solvent based seam cleaner used to clean exposed or contaminated seam prior to heat welding, Basis of Design: EverGuard Cleanweld Cleaner, or equal.

E. One part butyl based high viscosity sealant suitable for sealing between flashing membrane and substrate surface behind exposed termination bars and for sealing between roofing membrane and drain flange. Basis of Design: EverGuard Water-Block,.or equal.

F. Solvent based, trowel grade synthetic elastomeric sealant. Durable and UV resistant suitable for use where caulk is typically used. Available in 10 oz. tubes, Basis of Design: TOPCOAT FlexSeal Caulk Grade Roof Sealant or equal.

G. Commercial grade roofing sealant suitable for sealing the upper lip of exposed termination bars and penetrations and around clamping rings and comes with a 20 yr ltd warranty against leaks caused by manufacturing defects. Basis of Design TOPCOAT FlexSeal Roof Sealant, or equal.

H. One-part moisture cure, self-leveling sealant designed for use in pitch pans – Basis of Design: EverGuard One-Part Pourable Sealer or equal.

I. 100 percent solids epoxy based two-part sealant suitable for filling sealant pans at irregularly-shaped penetrations. Basis of Design Epoxy is part A. Polyamide is part B. EverGuard Two-Part Pourable Sealant, or equal.

J. Insulation Adhesive: 2-Part Roofing Adhesive per roof membrane manufacturer.

2.7 ACCESSORIES

A. PLATES AND FASTENERS

1. DrillTec Standard Screws: Standard duty alloy steel insulation fastener with CR-10 coating with a 0.215 inch diameter thread. Factory Mutual Standard 4470 Approved, #3 Phillips head for use on steel and wood decks.
2. DrillTec Heavy Duty ASAPSYMBOL 226 “Symbol” 10 2S Fastener: Assembled screw and 2” (52 mm) steel barbed plate. Alloy steel fastener with CR-10 coating with a .245” (6.2 mm) diameter thread. Factory Mutual Standard 4470 Approved, #3 Phillips truss head.
3. DrillTec Extra Heavy Duty ASAPSYMBOL 226 “Symbol” 10 Fastener: Assembled screw and 2-3/8” (60.3 mm) steel barbed plate. Alloy steel fastener with CR-10 coating with a .275” (6.9 mm) diameter thread. Factory Mutual Standard 4470 Approved, #3 Phillips truss head
4. DrillTec ASAP 3P Fastener: Assembled screw and 3 inch locking plastic plate. Alloy steel fastener with CR-10 coating with a 0.215 inch diameter thread. Factory Mutual Standard 4470 Approved, #3 Phillips truss head.
5. DrillTec ASAP 3S Fastener: Assembled screw and 3 inch steel plate. Alloy steel fastener with CR-10 coating with a 0.215 inch diameter thread. Factory Mutual Standard 4470 Approved, #3 Phillips truss head.
6. DrillTec HD Screws: Heavy gauge alloy steel fastener with CR-10 coating with a 0.245 inch diameter thread. Factory Mutual Standard 4470 Approved, #3 Phillips truss head for use on wood, concrete and steel decks.
7. DrillTec XHD Screws: Heavy gauge alloy steel fastener with CR-10 coating with a 0.275 inch diameter thread. Factory Mutual Standard 4470 Approved, #3 Phillips truss head for use on heavy steel decks.
8. DrillTec SXHD Screws: Heavy gauge alloy steel fastener with CR-10 coating with a 0.320 inch diameter thread. Factory Mutual Standard 4470 Approved, #3 Phillips truss head for use on specific FM assemblies on heavy steel decks.
9. DrillTec Polymer Screws: A large diameter glass filled nylon auger-type insulation and membrane fastener with a 1 inch head and with locking wire barbs. Major thread diameter of 0.750 inch. To be used with 3 inch (7.6 cm) Steel Round Plate or a 2 inch (51mm) barbed steel plate, for use on gypsum and cementitious wood fiber decks.
10. DrillTec Spikes: Hammer-in, non-threaded fastener designed to secure insulation and membrane to structural concrete. Alloy steel fastener with a CR-10 coating and a 0.250 inch shank diameter.
11. DrillTec Lite-Deck Fastener: A large diameter reinforced nylon screw with a #3 square drive flat head. Thread diameter of 0.375 inch and shank diameter of 0.312 inch. Uses a 3 inch (76mm) Metal Round Plate fastening system.
12. DrillTec CR Base Sheet Fastener: G-90 galvanized, CR-10 Corrosion resistant coating with 1.125 inch x1 inch head and 1 ¾ inch (4.4 cm) leg length. Preassembled with 2 ¾ inch (7 cm) diameter Galvalume steel roof disc.
13. DrillTec CR 1.2 Base Sheet Fastener: G-90 galvanized, CR-10 Corrosion resistant coating with 1.125 inch x1 inch head and 1.2 inch leg length. Preassembled with 2 ¾ inch (70mm) Diameter Galvalume steel roof disc.
14. DrillTec Insulation Plates: Galvalume, 3 inch (76mm) diameter, suitable for use with DrillTec Standard and HD screws, and DrillTec Spikes. Special design available for use with DrillTec Polymer Screws.
15. DrillTec XHD Plates: Galvalume, 2 3/8 inch (60mm) diameter, with a barbed underside. Suitable for use with DrillTec Standard, HD, and XHD Screws, and DrillTec Spikes.

16. DrillTec SXHD Plates: Galvalume, 2 ¾ inch (70mm) diameter, with a double barbed underside. Required for use with DrillTec SXHD Screws, HD Screws and DrillTec Spikes for specific FM assemblies.
17. DrillTec SHD Plates: Galvalume, 2 inch (51mm) diameter, with a double barbed underside. Suitable for use with DrillTec Standard, HD, XHD, and SXHD Screws, and DrillTec Spikes.
18. DrillTec Lite-Deck Plate: Galvalume plate with extra wide diameter designed specifically for Lite-Deck Fastener.
19. DrillTec Locking Impact Nail: Factory Assembled, G-90 Galvalume Coated fastener designed to install base sheets or insulation to gypsum or cementitious wood fiber. 1.8 inch to 4.8 inch lengths available with a 2.7 inch diameter plate.
20. DrillTec Purlin Fastener: Alloy steel fastener with CR-10 coating with a 0.210 inch diameter thread. Factory Mutual Standard 4470 Approved, ¼ inch (6mm) hex head. For use when mechanically fastening single-ply membranes in metal-retrofit applications.
21. Threaded Cap Nail: Annular-threaded electro-galvanized with yellow di-chromate coating, with 1 inch (25mm) round or square cap, as manufactured by The Simplex Corporation.
22. Two-Piece Tube Nail: 1 inch (25mm) diameter cap; when the nail is driven down through the tube of first part that was installed, the nail hooks up to provide backout resistance, as manufactured by The Simplex Corporation.
23. Nail-Tite Type-R Fasteners: Self-locking one-piece fastener for securing base ply when roofing over existing poured gypsum roof decks. Shank: 1 inch (25mm) tapered cone precision formed from corrosion resistant galvanized (G-90) steel. Cap: 1 ¼ inch (32mm) round cap formed from corrosion resistant Galvalume (AZ-55) steel, reinforced to resist cupping during driving. The shank is securely wedged to cap forming rigid one-piece fastener, by E. S. Products.

B. FLASHING ACCESSORIES
1. Provide inert separation sheet between dissimilar metals as approved by selected roof manufacturer.
2. A smooth type, unreinforced thermoplastic polyolefin based membrane for use as an alternative flashing/reinforcing material for penetrations and corners. Required whenever preformed vent boots cannot be used, available in Gray, 0.055 inches (55 mils) nominal thickness and sheet size: 24in x 50ft. Basis of Design: EverGuard Extreme TPO Detailing Membrane.
3. An 8 inch (200mm) wide smooth type, polyester scrim reinforced thermoplastic polyolefin membrane strip for use as a cover strip over coated metal and stripping-in coated metal flanges and general repairs: 0.045 inches (45 mils) nominal thickness with 100 foot length, available in Gray, Basis of Design: EverGuard Extreme TPO Flashing Strip.
4. Extruded aluminum termination bar with angled lip caulk receiver and lower leg bulb stiffener. Pre-punched slotted holes at 6” on center or 8” on center.3/4 inch x 10 feet with 0.090 inch cross section, Basis of Design: Drill-Tec Termination Bar.
5. A 6 inch (152 mm) wide, 0.045 mil reinforced TPO membrane with a 3-inch self-adhered area and a 3-inch heat-weld area. Designed for use as a cover strip over coated and non-coated metal edges and flanges. Each full roll contains approximately 100 Lineal feet of material, Basis of Design: EverGuard TPO Cover Tape Heat-Weld.
6. A 6 inch (14 cm) wide, smooth type, polyester scrim reinforced thermoplastic polyolefin membrane strip with a factory laminated butyl tape. Designed for use as a cover strip over non-coated metal edges and flanges. Each full roll contains

approximately 100 Lineal Ft. of material, Basis of Design: EverGuard Extreme TPO Cover Tape.

7. 0.045 inch (45 mil) reinforced TPO membrane with pressure sensitive adhesive, to be installed on horizontal surfaces using plates and fasteners as a base attachment in fully adhered systems. Size 6 inches x 100 feet, Basis of Design: EverGuard RTA (Roof Transition Anchor) Strip.
8. Two-part assembly with a rigid extruded termination base plate, and a decorative snap-on fascia cover for single-ply roofs. The system shall have all concealed fasteners with no penetration on horizontal roof surface available in 10' lengths, Basis of Design: EverGuard EZ Fascia EX.
9. Metal with 0.025 inch thick TPO based film as required for fabrication into metal gravel stop and drip edge profiles, metal base and curb flashings, sealant pans, and scupper sleeves. Standard sheet size 4 foot x 10 foot, sheet weight 50 lbs. Available in stainless steel and aluminum, Basis of Design: EverGuard Extreme TPO Coated Metal.
    a. Metal: 22 gauge aluminum.
    b. Available Stock Color: Gray.

C. WALL AND CURB ACCESSORIES

1. 55 mil TPO membrane and 24 gauge coated metal prefabricated into standard and custom size thru wall scuppers. Available in two sizes: 4 inch x 6 inch x 12 inch (l x w x d) with a 5.75 inch x 3.75 inch opening and 8 inch x 10 inch x 12 inch (l x w x d) with a 9.75 inch x 7.75 inch opening, Basis of Design: EverGuard Extreme TPO Scupper, or equal.
2. 0.045 inch or 0.060 inch thick reinforced TPO membrane fabricated corners. Available in four standard sizes to flash curbs that are 24 inch, 36 inch, 48 inch, and 60 inch in size. Four corners are required to flash the curb, Basis of Design: EverGuard Extreme TPO Corner Curb Wraps, or equal.
3. 0.060 inch thick molded TPO membrane outside corners of base and curb flashing. Hot-air welds directly to TPO membrane. Size 4 inch x 4 inch with 6 inch flange, Basis of Design: EverGuard Extreme TPO Universal Corners or equal.
4. 0.055 inch molded TPO membrane inside corners of base and curb flashing. Hot-air welds directly to Everguard TPO membrane. Size 6 inch x 6 inch x 5.5 inch high EverGuard Extreme TPO Preformed Corners or equal.
5. 8 inch diameter, nominal .050 inch vacuum formed unreinforced TPO membrane for use in flashing outside corners of base and curb flashings, EverGuard Extreme TPO Fluted Corner, or equal.

D. PENETRATION ACCESSORIES

1. 0.075 inch thick molded TPO membrane sized to accommodate most common pipe and conduits, (1 inch to 6 inch diameter pipes), including square tube. Hot-air welded directly to EverGuard TPO membrane, supplied with stainless steel clamping rings, EverGuard Extreme TPO Preformed Vent Boots or equal.
2. 0.045 inch or 0.60 inch thick molded TPO membrane preformed boots are split to accommodate most common pipes and conduits and available in three standard sizes, EverGuard Extreme TPO Split Pipe Boots, or equal.
3. 0.045 inch or 0.60 inch thick molded TPO membrane preformed square boots are split to accommodate most common square penetrations and conduits and available in three standard sizes, EverGuard Extreme TPO Square Tube Wraps, or equal.
4. 0.070 thick molded penetration pocket to provide structure and foundation for the application of a pourable sealant for a variety of roof penetrations , weldable and 9

inch x 6 inch x 4 inch (l x w x h) . EverGuard Extreme TPO Pourable Sealer Pocket or equal

5. 24 gauge steel with 0.025" thick TPO based film flanged drain, EverGuard TPO Coated Metal Drain or equal.

E. FIELD OF ROOF ACCESSORlES

1. Pre-manufactured expansion joint covers used to bridge expansion joint openings in a roof structure. Fabricated to accommodate all roof to wall and roof to roof applications, made of .060 inch reinforced TPO membrane, available in 5 standard sizes for expansion joint openings up to 8 inch wide. EverGuard Extreme TPO Expansion Joint Covers, or equal.
2. 0.055 inch thick smooth type, unreinforced thermoplastic polyolefin membrane designed for use as a conforming membrane seal over T-joints in 60 and 80 mil membrane applications. EverGuard Extreme T-Joint Patches, or equal.
3. 1/8" (3.18 mm) thick extruded and embossed TPO roll 30" x 50' (762 mm x 15.2 m), heat welds directly to roofing membrane. Unique herringbone traction surface. Gray in color, EverGuard TPO Walkway Rolls, or equal.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that the surfaces and site conditions are ready to receive work.

B. Verify that the deck is supported and secured.

C. Verify that the deck is clean and smooth, free of depressions, waves, or projections, and properly sloped to drains, valleys, eaves, scuppers or gutters.

D. Verify that the deck surfaces are dry and free of ice or snow.

E. Verify that all roof openings or penetrations through the roof are solidly set, and that all flashings are tapered.

3.2 SUBSTRATE PREPARATION

A. Steel Deck at Edgell Road Pumping Station

1. Metal decks shall be a minimum uncoated thickness of 22 gauge (0.8 mm) and shall have a G-90 galvanized finish on all panels.
2. Decks shall comply with the gauge and span requirements in the current Factory Mutual FM Approval Guide and be installed in accordance with Loss Prevention Data

B. Concrete at Saxonville Pump Station

1. Thoroughly inspect decking, flashing substrates, and wood nailers before installing new materials;
2. Plan a tear-off strategy so that roof drainage patterns are never blocked, and so that construction traffic is directed away from new roof areas;
3. Protect new roof areas adjacent to tear-off areas from dirt, debris, and damage.

3.3 INSTALLATION - GENERAL

A. Install Manufacturer's TPO roofing system according to all current application requirements in addition to those listed in this section.

B. Start the application of membrane plies at the low point of the roof or at the drains, so that the flow of water is over or parallel to, but never against the laps.

3.4 INSULATION - GENERAL

A. Do not apply roof insulation or roofing until all other work trades have completed jobs that require them to traverse the deck on foot or with equipment. A vapor retarder coated lightly with asphalt may be applied to protect the inside of the structure prior to the insulation and final roofing installation. Before the application of the insulation, any damage or deterioration to the vapor retarder shall be repaired.

B. Do not install wet, damaged or warped insulation boards.

C. Install insulation boards with staggered board joints in one direction (unless taping joint).

D. Install insulation boards snug. Gaps between board joints shall not exceed 1/4 inch (6 mm). All gaps in excess of 1/4 inch (6 mm) shall be filled with like insulation material.

E. Wood nailers shall be 3-1/2 inches (89 mm) minimum width or 1 inch (25 mm) wider than metal flange. They shall be of equal thickness as the insulation with a minimum 1 inch (25 mm) thickness. All nailers shall be securely fastened to the deck.

F. Do not kick insulation boards into place.

G. Miter and fill the edges of the insulation boards at ridges, valleys and other changes in plane to prevent open joints or irregular surfaces. Avoid breaking or crushing of the insulation at the corners.

H. Insulation shall not be installed over new lightweight insulating concrete.

I. Roof tape, if required over insulation joints, shall be laid evenly, smoothly and embedded in a uniform coating of hot steep asphalt with 4 inches (102 mm) end laps. Care shall be taken to assure smooth application of tape, and full embedment of the tape in the asphalt.

J. Do not install any more insulation than will be completely waterproofed each day.

3.5 INSULATION - BASE LAYER

A. The insulation shall be securely attached to the roof deck. A minimum FMRC 1-60 attachment is recommended. Refer to FMRC Approval Guide for FM fastening patterns. Factory Mutual requires fastener density increased in corner areas for FM 1-60 and perimeter, and corner area fastener density increases for FM 1-90 or greater. Refer to FM Loss Prevention Data Sheets 1-7, 1-28, and 1-49.

B. Use only fasteners with a minimum 3 inch (76 mm) stress plate when mechanically attaching insulation. Do not attach insulation with nails.
   1. The substrate must be free of and debris, dust, dirt, oil, grease, and standing water before applying the adhesive.
   2. If using foam adhesive in boxes, must be applied using the specially designed dispenser. Foam adhesive in cartridge format shall be applied using one of the specially designed dual cartridge dispensers.
   3. Apply bands of LRF adhesive spaced 6" to 12" (152 mm to 305 mm) o.c. Allow the foam to rise 3/4" to 1" (19.1 mm to 25.4 mm). Install installation boards. Walk each board firmly into place. Stagger the joints of additional layers in relation to the

insulation joints in the layer(s) below by a minimum of 6" (152 mm) to eliminate continuous vertical gaps. Repeat for each layer.

4. Do not install any more insulation than will be completely waterproofed each day.
5. Apply heavily textured spatter pattern coat 1/4" to 1/2" (6.4 mm to 13 mm) nominal thickness in height. Place insulation boards immediately in place. Do NOT walk in place or compress for 5 to 10 minutes depending on ambient temperature. Refer to product application instructions for specific times.
6. Do not install any more insulation than will be completely waterproofed each day.

C. Install insulation layers, maximum 4 feet by 4 feet (1.22 m by 1.22 m) board size, in a full and uniform mopping of hot asphalt applied at the rate of 25 lb/square (1.2 kg/sqm) 20 percent. Press each board firmly into place. Stagger the joints of additional layers in relation to the insulation joints in the layer(s) below by a minimum of 6 inches (152 mm) to eliminate continuous vertical gaps.

D. The substrate shall be free of debris, dust, dirt, oil, grease, and standing water before applying the adhesive.

E. Install insulation layers applied with beads of Oly Bond 500 spaced 12 inches (305 mm) O.C. Approximate coverage rate is one (1) gallon per 100 square feet (0.42 l/sm), depending on the substrate. Allow the foam to rise 1/2 inch to 3/4 inch (13 mm to 19 mm). Press each board firmly into place. Stagger the joints of additional layers in relation to the insulation joints in the layer(s) below by a minimum of 6 inches (152 mm) to eliminate continuous vertical gaps.

F. The substrate shall be free of debris, dust, dirt, oil, grease, and standing water before applying the adhesive.

G. Install insulation layers applied with 3/4 inch (19 mm) beads of Insta-Stik spaced 12 inches (305 mm) O.C. Press each board firmly into place. Stagger the joints of additional layers in relation to the insulation joints in the layer(s) below by a minimum of 6 inches (152 mm) to eliminate continuous vertical gaps.

H. Loose lay the base layer of insulation for subsequent layers to be simultaneously attached. Minimal fastening shall be performed to avoid movement of the boards.

3.6 INSULATION - SUBSEQUENT LAYERS

A. The insulation shall be securely attached to the roof deck. A minimum FMRC 1-60 attachment is recommended. Refer to FMRC Approval Guide for FM fastening patterns. Factory Mutual requires fastener density increased in corner areas for FM 1-60 and perimeter, and corner area fastener density increases for FM 1-90 or greater. Refer to FM Loss Prevention Data Sheets 1-7, 1-28, and 1-49.

B. Multiple layers of insulation of the same, non-tapered insulation material may be simultaneously mechanically fastened with approved fasteners and plates through the top layer of insulation to the structural deck. Individual layers of insulation shall not exceed 3 inches (7.6 mm) in thickness nor total thickness of all layers shall not exceed 5 inches (127 mm) without written approval of THE MANUFACTURER'S Contractor Services.

C. Use only fasteners with a minimum 3 inch (76 mm) stress plate when mechanically attaching insulation. Do not attach insulation with nails.

1. The substrate must be free of and debris, dust, dirt, oil, grease, and standing water

before applying the adhesive.

2. If using foam adhesive in boxes, must be applied using the specially designed dispenser. Foam adhesive in cartridge format shall be applied using one of the specially designed dual cartridge dispensers.
3. Apply bands of LRF adhesive spaced 6" to 12" (152 mm to 305 mm) o.c. Allow the foam to rise 3/4" to 1" (19.1 mm to 25.4 mm). Install installation boards. Walk each board firmly into place. Stagger the joints of additional layers in relation to the insulation joints in the layer(s) below by a minimum of 6" (152 mm) to eliminate continuous vertical gaps. Repeat for each layer.
4. Do not install any more insulation than will be completely waterproofed each day.
5. Apply heavily textured spatter pattern coat 1/4" to 1/2" (6.4 mm to 13 mm) nominal thickness in height. Place insulation boards immediately in place. Do NOT walk in place or compress for 5 to 10 minutes depending on ambient temperature. Refer to product application instructions for specific times.
6. Do not install any more insulation than will be completely waterproofed each day.

D. Install insulation layers, maximum 4 feet by 4 feet (1.22 m by 1.22 m) board size, in a full and uniform mopping of hot asphalt applied at the rate of 25 lb/square (1.2 kg/sm) 20 percent. Press each board firmly into place. Stagger the joints of additional layers in relation to the insulation joints in the layer(s) below by a minimum of 6 inches (152 mm) to eliminate continuous vertical gaps.

E. The substrate shall be free of debris, dust, dirt, oil, grease, and standing water before applying the adhesive.

F. Install insulation layers applied with beads of Oly Bond 500 spaced 12 inches (305 mm) O.C. Approximate coverage rate is one (1) gallon per 100 square feet (0.42l/sm), depending on the substrate. Allow the foam to rise 1/2 inch to 3/4 inch (13 mm to 19 mm). Press each board firmly into place. Stagger the joints of additional layers in relation to the insulation joints in the layer(s) below by a minimum of 6 inches (152 mm) to eliminate continuous vertical gaps.

G. The substrate shall be free of debris, dust, dirt, oil, grease, and standing water before applying the adhesive.

H. Install insulation layers applied with 3/4 inch (19 mm) beads of Insta-Stik spaced 12 inches (305 mm) O.C. Press each board firmly into place. Stagger the joints of additional layers in relation to the insulation joints in the layer(s) below by a minimum of 6 inches (152 mm) to eliminate continuous vertical gaps.

I. Do not install any more insulation than will be completely waterproofed each day.

3.7 PROTECTION LAYER

A. Polymat protection layer shall be installed between the roofing membrane and the substrate.

B. Fire sheet 50 or 10 fiberglass sheet protection layer shall typically be installed when required by design professionals or code authority to address code or approval requirements or as a separator layer.

C. Install fiberglass sheet or polymat protection layer loose-applied over substrate surface so that wrinkles and buckles are not formed.

D. Overlap sheets a minimum of 6" for side and end laps.

3.8 MEMBRANE APPLICATION

A. Fully Adhered (Adhesive):
1. Place membrane so that wrinkles and buckles are not formed. Any wrinkles or buckles must be removed from the sheet prior to permanent attachment. Roof membrane shall be fully adhered immediately after it is rolled out, followed by welding to adjacent sheets.
2. Overlap roof membrane a minimum of 3 inches (76mm) for side laps and 3 inches (76mm) for end laps.
3. Install membrane so that the side laps run across the roof slope lapped towards drainage points.
4. All exposed sheet corners shall be rounded a minimum of 1 inch.
5. Use full width rolls in the field and perimeter region of roof.
6. Use appropriate bonding adhesive for substrate surface, applied with a solvent-resistant roller, brush or squeegee.
7. All work surfaces should be clean, dry, and free of dirt, dust, debris, oils, loose and/or embedded gravel, un-adhered coatings, deteriorated membrane, and other contaminants that may result in a surface that is not sound or is uneven.
8. Apply LRF Adhesive directly to the substrate using a ribbon pattern. Space beads as required by job specification, typically 6" or 12" (152 mm or 305 mm) o.c.
9. Basis of Design GAF LRF M Adhesive should be approximately 70 degreesF (22 degreesC) when being dispensed. As adhesive is applied, allow the adhesive to begin rising, then place membrane.
10. Roll in membrane using a 150 lb. membrane roller or equivalent
11. Apply bonding adhesive at 3 squares of finished, mated surface area per 5 gallons (Solvent Based) and 5 squares of finished, mated surface area per 5 gallons (Water Based). A greater quantity of bonding adhesive may be required based upon the substrate surface condition.
12. Apply bonding adhesive to the substrate surface only at 300 square feet per 5 gallons (Solvent Based) and 600 square feet per 5 gallons (Water Based). A greater quantity of bonding adhesive may be required based upon the substrate surface condition.
13. Prevent seam contamination by keeping the adhesive application a few inches back from the seam area.
14. Adhere approximately one half of the membrane sheet at a time. One half of the sheet's length shall be folded back in turn to allow for adhesive application. Lay membrane into adhesive once the bonding adhesive is tacky to the touch.
15. Roll membrane with a weighted roller to ensure complete bonding between adhesive and membrane.
16. Membrane laps shall be heat-welded together. All welds shall be continuous, without voids or partial welds. Welds shall be free of burns and scorch marks.
17. Weld shall be a minimum of 1 1/2 inches (39mm) in width for automatic machine welding and a minimum 2 inches (51mm) in width for hand welding.
18. All cut edges of reinforced membrane must be sealed with EverGuard TPO Cut Edge Sealant.
19. Supplemental membrane attachment is required at the base of all walls and curbs, and where the angle of the substrate changes by more than five (5) degrees (1 inch in 12 inches). Roofing membrane shall be secured to the structural deck with appropriate Drill-Tec screws and plates spaced every 12 inches o.c. The screws and plates must be installed no less than 1/2 inch from the membrane edge. Alternatively, the roofing

membrane may be turned up the vertical plane a minimum of 3 inches and secured with screws and termination bar Fastener spacing is the same as is used for in-lap attachment. The termination bar must be installed within 1 1/2 to 2 inches of the plane of the roof membrane, with a minimum of 1 inch of membrane extending above the termination bar.

20. Supplemental membrane attachment to the structural deck is required at all penetrations unless the insulation substrate is fully adhered to the deck. Roofing membrane shall be secured to the deck with appropriate Drill-Tec screws and plates.
21. Fasteners must be installed to achieve the proper embedment depth. Install fasteners without lean or tilt.
22. Install fasteners so that the plate or termination bar is drawn down tightly to the membrane surface. Properly installed fasteners will not allow the plate or termination bar to move (underdriving), but will not cause wrinkling of the membrane (overdriving).

3.9 FLASHINGS

A. All penetrations shall be at least 2 feet (610 mm) from the curbs, walls, and edges to provide adequate space for proper flashing.

B. Flash all perimeter, curb, and penetration conditions with coated metal, membrane flashing, and flashing accessories as appropriate to the site condition.

C. All coated metal and membrane flashing corners shall be reinforced with preformed corners or non-reinforced membrane.

D. Hot-air weld all flashing membranes, accessories, and coated metal. A minimum 2 inch wide hand weld or minimum 1 1/2 inch automatic machine weld is required.

E. Non-coated metal edge details shall be installed in accordance with manufacturer's construction details and requirements.

F. Twenty (20) year EverGuard systems require the use of coated metal edges where applicable. Bonding adhesive and/or cover tape is not acceptable.

G. All cut edges of reinforced membrane shall be sealed with manufacturer's TPO Cut Edge Sealant.

3.10 FLASHINGS

A. General:
   1. All penetrations must be at least 24 inches (610mm) from curbs, walls, and edges to provide adequate space for proper flashing.
   2. Flash all perimeter, curb, and penetration conditions with coated metal, membrane flashing, and flashing accessories as appropriate to the site condition.
   3. All coated metal and membrane flashing corners shall be reinforced with preformed corners or non-reinforced membrane.
   4. Hot-air weld all flashing membranes, accessories, and coated metal. A minimum 2 inch (51mm) wide (hand welder) weld is required.
   5. All cut edges of reinforced membrane must be sealed with EverGuard TPO Cut Edge Sealant.
   6. Consult the manufacturer's Application and Specifications Manual or manufacturer's Contractor Services for more information on specific construction details, or those not

addressed in this section.

B. Coated Metal Flashings:
   1. Coated metal flashings shall be formed in accordance with current EverGuard construction details and SMACNA guidelines.
   2. Coated metal sections used for roof edging, base flashing and coping shall be butted together with a 1/4 inch (6mm) gap to allow for expansion and contraction. Hot-air weld a 6 inch (152mm) wide reinforced membrane flashing strip to both sides of the joint, with approximately 1 inch (25mm) on either side of the joint left un-welded to allow for expansion and contraction. 2 inch (51mm) wide aluminum tape can be installed over the joint as a bond-breaker, to prevent welding in this area.
   3. Coated metal used for sealant pans, scupper inserts, corners of roof edging, base flashing and coping shall be overlapped or provided with separate metal pieces to create a continuous flange condition, and pop-riveted securely. Hot-air weld a 6 inch (152mm) wide reinforced membrane flashing strip over all seams that will not be sealed during subsequent flashing installation.
   4. Provide a 1/2 inch (13mm) hem for all exposed metal edges to provide corrosion protection and edge reinforcement for improved durability.
   5. Provide a 1/2 inch (13mm) hem for all metal flange edges whenever possible to prevent wearing of the roofing and flashing membranes at the flange edge.
   6. Coated metal flashings shall be nailed to treated wood nailers or otherwise mechanically attached to the roof deck, wall or curb substrates, in accordance with construction detail requirements.

C. Un-reinforced Membrane Flashings:
   1. Un-reinforced membrane is used to field-fabricate penetration or reinforcement flashings in locations where preformed corners and pipe boots cannot be properly installed.
   2. Penetration flashings constructed of un-reinforced membrane are typically installed in two sections, a horizontal piece that extends onto the roofing membrane and a vertical piece that extends up the penetration. The two pieces are overlapped and hot-air welded together.
   3. The un-reinforced membrane flashing shall be adhered to the penetration surface. Apply bonding adhesive at a rate resulting in 60 square feet/gallon of finished roofing material for solvent-based bonding adhesives, and at a rate of 125 square feet/gallon of finished roofing material for water-borne bonding adhesive. Apply bonding adhesive to both the underside of the membrane and the substrate surface at 120 square feet per gallon (Solvent Based) and 250 square feet per gallon (Water Based). A greater quantity of bonding adhesive may be required based upon the substrate surface condition. The bonding adhesive must be allowed to dry until tacky to the touch before flashing membrane application.

D. Reinforced Membrane Flashings:
   1. The thickness of the flashing membrane shall be the same as the thickness of the roofing membrane.
   2. Membrane flashing may either be installed loose or fully adhered to the substrate surface in accordance with 'Construction Detail Requirements'.
   3. Where flashings are to be fully adhered, apply bonding adhesive at a rate resulting in 60 square feet/gallon of finished roofing material for solvent-based bonding adhesives, and at a rate of 125 square feet/gallon of finished roofing material for water-borne bonding adhesive. Apply bonding adhesive to both the underside of the

membrane and the substrate surface at 120 square feet per gallon (Solvent Based) and 250 square feet per gallon (Water Based). A greater quantity of bonding adhesive may be required based upon the substrate surface condition. The bonding adhesive must be allowed to dry until tacky to the touch before flashing membrane application.

4. Apply the adhesive only when outside temperature is above 40 degrees F. Recommended minimum application temperature is 50 degrees F to allow for easier adhesive application.
5. The membrane flashing shall be carefully positioned prior to application to avoid wrinkles and buckles.

E. Roof Edges:
   1. Roof edge flashings are applicable for gravel stop and drip edge conditions as well as for exterior edges of parapet walls.
   2. Flash roof edges with metal flanges nailed 4 inches (102mm) o.c. to pressure-treated wood nailers. Where required, hot-air weld roof membrane to coated metal flanges.
   3. When the fascia width exceeds 4 inches (102mm), coated metal roof edging must be attached with a continuous cleat to secure the lower fascia edge. The cleat must be secured to the building no less than 12 inches (305mm) O.C.
   4. Alternatively, roof edges may be flashed with a 2-piece snap on fascia system, adhering the roof membrane to a metal cant and face nailing the membrane 8 inches on center prior to installing a snap-on fascia.
   5. Flash roof edge scuppers with a coated metal insert that is mechanically attached to the roof edge and integrated as a part of the metal edging.

F. Parapet and Building Walls:
   1. Copper flashing 20 oz/sf (22 guage) typical.
   2. Flash walls with EverGuard (BOD) TPO membrane adhered to the substrate with bonding adhesive, loose applied (Less than 18 inches (457mm) in height) or with coated metal flashing nailed 4 inches (102mm) on center to pressure-treated wood nailers.
   3. Secure membrane flashing at the top edge with a termination bar. Water Block shall be applied between the wall surface and membrane flashing underneath all exposed termination bars. Exposed termination bars shall be mechanically fastened 8 inches (203mm) on center; termination bars that are counter flashed shall be fastened 12 inches (305mm) on center.
   4. Roof membrane must be mechanically attached along the base of walls with screws and plates (deck securement) or screws and inverted termination bar (wall securement) at the following rate:
      a. Mechanically Attached Systems: Per in-lap on center spacing, with a 12 inch (305mm) maximum.
      b. Fully / Self Adhered Systems: 12 inches (305mm) on center
   5. All coated metal wall flashings and loose applied membrane flashings must be provided with separate metal counterflashings, or metal copings.
   6. Metal counterflashings may be optional with fully adhered flashings depending on guarantee requirements. Exposed termination bars must be sealed with EverGuard caulking.
   7. Flash wall scuppers with a coated metal insert that is mechanically attached to the wall and integrated as part of the wall flashing.

G. Curbs and Ducts:
   1. Flash curbs and ducts with EverGuard TPO membrane adhered to the curb substrate

with bonding adhesive, loose applied (Less than 18 inches (457mm) in height) or with coated metal flashing nailed 4 inches (102mm) on center to pressure-treated wood nailers.

2. Secure membrane flashing at the top edge with a termination bar. Water Block shall be applied between the curb/duct surface and membrane flashing underneath all termination bars. Exposed termination bars shall be mechanically fastened every 8 inches (203mm) o.c.; termination bars that are counter flashed shall be fastened 12 inches (305mm) on center.
3. Roof membrane must be mechanically attached along the base of walls with screws and plates (deck securement) or screws and inverted termination bar (wall securement) at the following rate:
    a. Mechanically Attached Systems: Per in-lap on center spacing, with a 12 inches (305mm) maximum
    b. Fully / Self Adhered Systems: 12 inches (305mm) on center
4. All coated metal curb flashings and loose applied membrane flashings must be provided with separate metal counterflashings, or metal copings.
5. Metal counterflashings may be optional with fully adhered flashings depending on guarantee requirements. Exposed termination bars must be sealed with EverGuard caulking.

3.11 TRAFFIC PROTECTION

A. Install walkway pads/rolls at all roof access locations and other designated locations including roof-mounted equipment work locations and areas of repeated rooftop traffic.

B. Walkway pads shall be spaced 2 inches (51mm) apart to allow for drainage between the pads.

C. Fully adhere walkway pads/rolls to the roof membrane with solvent-based bonding adhesive, applied at the rate of 1 gal per 100 sf (0.42 l/sm) to both the walkway and roof membrane surfaces. Press walkway in position once adhesive is tacky to the touch.

D. Alternatively, walkway pads/rolls may be hot-air-welded to the roof membrane surface continuously around the perimeter of the pad/roll.

3.12 ROOF PROTECTION

A. Protect all partially and fully completed roofing work from other trades until completion.

B. Whenever possible, stage materials in such a manner that foot traffic is minimized over completed roof areas.

C. When it is not possible to stage materials away from locations where partial or complete installation has taken place, temporary walkways and platforms shall be installed in order to protect all completed roof areas from traffic and point loading during the application process.

D. Temporary tie-ins shall be installed at the end of each workday and removed prior to commencement of work the following day.

3.13 CLEAN-UP

A. All work areas are to be kept clean, clear and free of debris at all times.

B. Do not allow trash, waste, or debris to collect on the roof. These items shall be removed from the roof on a daily basis.

C. All tools and unused materials shall be collected at the end of each workday and stored properly off of the finished roof surface and protected from exposure to the elements.

D. Dispose of or recycle all trash and excess material in a manner conforming to current EPA regulations and local laws.

E. Properly clean the finished roof surface after completion, and make sure the drains and gutters are not clogged.

F. Clean and restore all damaged surfaces to their original condition.

3.14 MAINTENANCE

A. Inspections to the roof shall be performed annually by a the manufacturer's contractor.

B. An annual roofing system maintenance program shall be performed by a Master Select contractor in accordance with the manufacturer's maintenance program, Basis of Design: GAF 10 Point Maintenance Program provided with Diamond Pledge guarantee.

C. Submit copies of the roof inspection form, accompanying photographs (a minimum of 6 photos showing the condition of the roof and critical details), and a record of all roofing system maintenance to the roof assembly manufacturer's Contractor Services Department within sixty (60) days of the anniversary date of the completion of the roofing system. Annual roof inspections must be started within the first two (2) years of the guarantee term.

END OF SECTION

SECTION 07620

SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.01 GENERAL PROVISIONS

A. 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.

1.02 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
   1. Sheet metal flashing and trim at exterior windows and doors.
   2. Sheet metal flashing and trim at precast roof parapet.
   3. Sheet metal flashing and trim at base of exterior wall (through-wall flashing).
   4. Copper box gutters, downspouts, trim, flashing.

B. Related Work: The following items are not included in this Section and are specified under the designated Sections:
   1. Section 04200 - UNIT MASONRY for through-wall flashings in masonry.
   2. Section 04210 – ARCHITECTURAL FACE BRICK for through wall flashings.
   3. Section 06100 - ROUGH CARPENTRY for wood nailers, curbs, and blocking.
   4. Section 07270 - AIR BARRIERS for perimeter terminations at air and vapor barrier assembly.
   5. Section 07210 – THERMOPLASTIC ROOFING
   6. Section 07920 - JOINT SEALANTS for field-applied sheet metal flashing and trim sealants.

1.03 PERFORMANCE REQUIREMENTS

A. General: Install sheet metal flashing and trim to withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failing, rattling, leaking, and fastener disengagement.

B. Fabricate and install roof edge flashing and copings capable of resisting Wind Zone forces required by Code according to recommendations in FMG Loss Prevention Data Sheet 1-49.

C. Thermal Movements: Provide sheet metal flashing and trim that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other

detrimental effects. Provide clips that resist rotation and avoid shear stress as a result of sheet metal and trim thermal movements. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F material surfaces.

D. Water Infiltration: Provide sheet metal flashing and trim that do not allow water infiltration to building interior.

1.04 SUBMITTALS

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

B. Shop Drawings: Show layouts of sheet metal flashing and trim, including plans and elevations. Distinguish between shop- and field-assembled work. Include the following:

1. Identify material, thickness, weight, and finish for each item and location in Project.
2. Details for forming sheet metal flashing and trim, including profiles, shapes, seams, and dimensions.
3. Details for fastening, joining, supporting, and anchoring sheet metal flashing and trim, including fasteners, clips, cleats, and attachments to adjoining work.
4. Details of expansion-joint covers, including showing direction of expansion and contraction.

C. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below:

1. Sheet Metal Flashing: 12 inches long. Include fasteners, cleats, clips, closures, and other attachments.
2. Trim: 12 inches long. Include fasteners and other exposed accessories.
3. Accessories: Full-size Sample.

1.05 QUALITY ASSURANCE

A. Sheet Metal Flashing and Trim Standard: Comply with SMACNA's "Architectural Sheet Metal Manual." Conform to dimensions and profiles shown unless more stringent requirements are indicated.

B. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01.

1. Meet with the Owner, Engineer and Owner’s insurer if applicable, Installer, and installers whose work interfaces with or affects sheet metal flashing and trim including installers of roofing materials, roof accessories, unit skylights, and roof-mounted equipment.

2. Review methods and procedures related to sheet metal flashing and trim.
3. Examine substrate conditions for compliance with requirements, including flatness and attachment to structural members.
4. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver sheet metal flashing materials and fabrications undamaged. Protect sheet metal flashing and trim materials and fabrications during transportation and handling.

B. Unload, store, and install sheet metal flashing materials and fabrications in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack materials on platforms or pallets, covered with suitable weathertight and ventilated covering. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage.

1.07 COORDINATION

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

PART 2 - PRODUCTS

2.01 SHEET METALS & PIPE

A. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304, with No. 2D dull, cold rolled finish. Thickness as specified in this Section.

B. Copper Sheet: Copper flashing 20 oz/sf (22 gauge) .

C. Copper Piping (downspout) 11 gauge .

2.02 UNDERLAYMENT MATERIALS

A. Felts: ASTM D 226, Type II (No. 30), asphalt-saturated organic felt, nonperforated.

B. Slip Sheet: Rosin-sized paper, minimum 3 lb/100 sq. ft.

2.03 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation.

B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads.

1. Exposed Fasteners: Heads matching color of sheet metal by means of plastic caps or factory-applied coating.
2. Fasteners for Flashing and Trim: Blind fasteners or self-drilling screws, gasketed, with hex washer head.
3. Blind Fasteners: High-strength stainless-steel rivets.

C. Solder for Stainless Steel: ASTM B 32, Grade Sn60, with acid flux of type recommended by stainless-steel sheet manufacturer.

D. Sealing Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealing tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape.

E. Elastomeric Sealant: ASTM C 920, elastomeric polyurethane polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

F. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

G. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

2.04 FABRICATION, GENERAL

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

B. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.

C. Fabricate sheet metal flashing and trim without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.
1. Seams: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.

D. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA recommendations.

E. Expansion Provisions: Where lapped or bayonet-type expansion provisions in the Work cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with elastomeric sealant concealed within joints.

F. Conceal fasteners and expansion provisions where possible on exposed-to-view sheet metal flashing and trim, unless otherwise indicated.

G. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.

1. Thickness: As recommended by SMACNA's "Architectural Sheet Metal Manual" for application but not less than thickness of metal being secured.

2.05 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions and other conditions affecting performance of work.

1. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION, GENERAL

A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.

1. Torch cutting of sheet metal flashing and trim is not permitted.

B. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by fabricator or manufacturers of dissimilar metals.

1. Coat side of stainless-steel sheet metal flashing and trim with bituminous coating where flashing and trim will contact wood, ferrous metal, or cementitious construction.
2. Underlayment: Where installing metal flashing directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip-sheet or install a course of polyethylene underlayment.
3. Bed flanges in thick coat of asphalt roofing cement where required for waterproof performance.

C. Install exposed sheet metal flashing and trim without excessive oil canning, buckling, and tool marks.

D. Install sheet metal flashing and trim true to line and levels indicated. Provide uniform, neat seams with minimum exposure of solder, welds, and elastomeric sealant.

E. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.

1. Space cleats not more than 12 inches apart. Anchor each cleat with two fasteners. Bend tabs over fasteners.

F. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped or bayonet-type expansion provisions cannot be used or would not be sufficiently watertight, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with elastomeric sealant concealed within joints.

G. Fasteners: Use fasteners of sizes that will penetrate substrate not less than 1-1/4 inches for nails and not less than 3/4 inch for wood screws.
1. Stainless Steel: Use stainless-steel fasteners.

H. Seal joints with elastomeric sealant as required for watertight construction.

1. Where sealant-filled joints are used, embed hooked flanges of joint members not less than 1 inch into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is moderate, between 40 and 70 deg F set joint members for 50 percent movement either way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F.
2. Prepare joints and apply sealants to comply with requirements in Section 07920 - JOINT SEALANTS.

I. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pretin edges of sheets to be soldered to a width of 1-1/2 inches except where pretinned surface would show in finished Work.

1. Stainless-Steel Soldering: Pretin edges of uncoated sheets to be soldered using solder recommended for stainless steel and phosphoric acid flux. Promptly wash off acid flux residue from metal after soldering.
2. Do not use open-flame torches for soldering. Heat surfaces to receive solder and flow solder into joints. Fill joints completely. Completely remove flux and spatter from exposed surfaces.

3.03 CLEANING AND PROTECTION

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean and neutralize flux materials. Clean off excess solder and sealants.

C. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed. On completion of installation, clean finished surfaces, including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain in a clean condition during construction.

D. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

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SECTION 07841

PENETRATION FIRESTOPPING

PART 1 - GENERAL

1.01 GENERAL PROVISIONS

A. 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.

1.02 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Through-penetration firestop systems for penetrations through fire-resistance-rated constructions, including both empty openings and openings containing penetrating items.

B. Related Work: The following items are not included in this Section and will be performed under the designated Sections:

1. Section 07844 - FIRE-RESISTIVE JOINT SYSTEMS for fire-resistive joint sealers.
2. Section 07920 - JOINT SEALANTS for standard joint sealers.
3. Division 21 - FIRE SUPPRESSION for fire-protection piping penetrations.
4. Division 22 - PLUMBING for piping penetrations.
5. Division 23 - HEATING, VENTILATING AND AIR CONDITIONING for duct and piping penetrations.
6. Division 26 - ELECTRICAL for cable and conduit penetrations.

1.03 COORDINATION

A. Jobsite conditions of each through-penetration firestop system must meet all details of the UL-Classified System selected. If jobsite conditions do not match any UL-classified systems, contact firestop manufacturer for alternative systems or Engineer Judgment Drawings.

B. Coordinate work with other trades to assure that penetration-opening sizes are appropriate for penetrant locations.

C. Verify that the schedule is current at the time of construction, and that each referenced system is suitable for the intended application.

1.04 PERFORMANCE REQUIREMENTS

A. General: For penetrations through fire-resistance-rated constructions, including both empty openings and openings containing penetrating items, provide through-penetration firestop systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated.

B. Penetrations in Fire-Resistance-Rated Walls: Provide penetration firestopping with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg (2.49 Pa).

1. Fire-resistance-rated walls include fire walls, fire-barrier walls, smoke-barrier walls and fire partitions.
2. F-Rating: Not less than the fire-resistance rating of constructions penetrated.

C. Penetrations in Horizontal Assemblies: Provide penetration firestopping with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg (2.49 Pa).

1. Horizontal assemblies include floors, floor/ceiling assemblies and ceiling membranes of roof/ceiling assemblies.
2. F-Rating: At least 1 hour, but not less than the fire-resistance rating of constructions penetrated.
3. T-Rating: At least 1 hour, but not less than the fire-resistance rating of constructions penetrated except for floor penetrations within the cavity of a wall.

D. Penetrations in Smoke Barriers: Provide penetration firestopping with ratings determined per UL 1479.

1. L-Rating: Not exceeding 5.0 cfm/sq. ft. (0.025 cu. m/s per sq. m) of penetration opening at 0.30-inch wg (74.7 Pa) at both ambient and elevated temperatures.

E. Exposed Penetration Firestopping:

1. Provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.
2. For through-penetration firestop systems exposed to view, traffic, moisture, and physical damage, provide products that, after curing, do not deteriorate when exposed to these conditions both during and after construction.
    a. For piping penetrations for plumbing and wet-pipe sprinkler systems, provide moisture-resistant through-penetration firestop systems demonstrating no evidence of water leakage when tested according to UL 1479.
    b. For floor penetrations with annular spaces exceeding 4 inches in width and exposed to possible loading and traffic, provide firestop systems capable of supporting floor loads involved, either by installing floor plates or by other means.

F. For penetrations involving insulated piping, provide through-penetration firestop systems not requiring removal of insulation.

1.05 SUBMITTALS

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

B. Shop Drawings: For each through-penetration firestop system, show each type of construction condition penetrated, relationships to adjoining construction, and type of penetrating item. Include firestop design designation of qualified testing and inspecting agency that evidences compliance with requirements for each condition indicated.

1. Submit documentation, including illustrations, from a qualified testing and inspecting agency that is applicable to each through-penetration firestop system configuration for construction and penetrating items.

C. Through-Penetration Firestop System Schedule: Indicate locations of each through-penetration firestop system, along with the following information:

1. Types of penetrating items.
2. Types of constructions penetrated, including fire-resistance ratings and, where applicable, thicknesses of construction penetrated.
3. Through-penetration firestop systems for each location identified by firestop design designation of qualified testing and inspecting agency.

D. Qualification Data: For Installer.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: Either a firm that has been approved by FMG according to FMG 4991, "Approval of Firestop Contractors" or a firm experienced in installing through-penetration firestop systems similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction of a minimum of five projects with a record of successful performance. Qualifications include having the necessary experience, staff, and training to install manufacturer's products per specified requirements.

B. Source Limitations: Obtain through-penetration firestop systems, for each kind of penetration and construction condition indicated, through one source from a single manufacturer.

C. Fire-Test-Response Characteristics: Provide through-penetration firestop systems that comply with the following requirements and those specified in Part 1 "Performance Requirements" Article:

1. Firestopping tests are performed by a qualified testing and inspecting agency. A qualified testing and inspecting agency is UL or another agency performing

testing and follow-up inspection services for firestop systems acceptable to authorities having jurisdiction.

2. Through-penetration firestop systems are identical to those tested per testing standard referenced in "Part 1 Performance Requirements" Article. Provide rated systems complying with the following requirements:

    a. Through-penetration firestop system products bear classification marking of qualified testing and inspecting agency.
    b. Through-penetration firestop systems correspond to those indicated by reference to through-penetration firestop system designations listed in the UL “Fire Resistance Directory.”

D. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver through-penetration firestop system products to Project site in original, unopened containers or packages with intact and legible manufacturers' labels identifying product and manufacturer, date of manufacture, lot number, shelf life if applicable, qualified testing and inspecting agency's classification marking applicable to Project, curing time, and mixing instructions for multicomponent materials.

B. Store and handle materials for through-penetration firestop systems to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes.

1.08 PROJECT CONDITIONS

A. Environmental Limitations: Do not install through-penetration firestop systems when ambient or substrate temperatures are outside limits permitted by through-penetration firestop system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.

B. Ventilate through-penetration firestop systems per manufacturer's written instructions by natural means or, where this is inadequate, forced-air circulation.

1.09 COORDINATION

A. Coordinate construction of openings and penetrating items to ensure that through-penetration firestop systems are installed according to specified requirements.

B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate through-penetration firestop systems.

C. Do not cover up through-penetration firestop system installations that will become concealed behind other construction until each installation has been examined building inspector, if required by authorities having jurisdiction.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Available Products: Subject to compliance with requirements, through-penetration firestop systems that may be incorporated into the Work include, but are not limited to the following:

1. Hilti, Inc.
2. BioFireshield; RectorSeal Corporation.
3. Specified Technologies, Inc. (STI).
4. 3M; Fire Protection Products Division.

2.02 FIRESTOPPING MATERIALS

A. VOC Content: Penetration firestopping sealants and sealant primers shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

1. Sealants: 250 g/L.
2. Sealant Primers for Nonporous Substrates: 250 g/L.
3. Sealant Primers for Porous Substrates: 775 g/L.

B. Compatibility: Provide through-penetration firestop systems that are compatible with one another; with the substrates forming openings; and with the items, if any, penetrating through-penetration firestop systems, under conditions of service and application, as demonstrated by through-penetration firestop system manufacturer based on testing and field experience.

C. Materials: Provide through-penetration firestop systems containing primary materials and fill materials which are part of the tested assemblies indicated in the approved Through-Penetration Firestop System Schedule submittal. Fill materials are those referred to in directories of referenced testing and inspecting agencies as "fill," "void," or "cavity" materials.

D. Accessories: Provide components for each through-penetration firestop system that are needed to install fill materials and to comply with Part 1 "Performance Requirements" Article. Use only components specified by through-penetration firestop system manufacturer and approved by qualified testing and inspecting agency for firestop systems indicated

2.03 MIXING

A. For those products requiring mixing before application, comply with through-penetration firestop system manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to

produce products of uniform quality with optimum performance characteristics for application indicated.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of work. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Surface Cleaning: Clean out openings immediately before installing through-penetration firestop systems to comply with firestop system manufacturer's written instructions and with the following requirements:

1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of through-penetration firestop systems.
2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with through-penetration firestop systems. Remove loose particles remaining from cleaning operation.
3. Remove laitance and form-release agents from concrete.

B. Priming: Prime substrates where recommended in writing by through-penetration firestop system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

C. Masking Tape: Use masking tape to prevent through-penetration firestop systems from contacting adjoining surfaces that will remain exposed on completion of Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove smears from firestop system materials. Remove tape as soon as possible without disturbing firestop system's seal with substrates.

3.03 THROUGH-PENETRATION FIRESTOP SYSTEM INSTALLATION

A. General: Install through-penetration firestop systems to comply with Part 1 "Performance Requirements" Article and with firestop system manufacturer's written installation instructions and published drawings for products and applications indicated.

B. Install forming/damming/backing materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.

C. Install fill materials for firestop systems by proven techniques to produce the following results:

1. Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items as required to achieve fire-resistance ratings indicated.
2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
3. For fill materials that will remain exposed after completing Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.04 FIELD QUALITY CONTROL

A. Inspecting Agency: Engage a qualified, independent inspecting agency to inspect through-penetration firestops. Independent inspecting agency shall comply with ASTM E 2174 requirements including those related to qualifications, conducting inspections, and preparing test reports.

B. Where deficiencies are found, repair or replace through-penetration firestop systems so they comply with requirements.

C. Proceed with enclosing through-penetration firestop systems with other construction only after inspection reports are issued and firestop installations comply with requirements.

3.05 CLEANING AND PROTECTING

A. Clean off excess fill materials adjacent to openings as Work progresses by methods and with cleaning materials that are approved in writing by through-penetration firestop system manufacturers and that do not damage materials in which openings occur.

B. Provide final protection and maintain conditions during and after installation that ensure that through-penetration firestop systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated through-penetration firestop systems immediately and install new materials to produce systems complying with specified requirements.

END OF SECTION

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SECTION 07920

JOINT SEALANTS

PART 1 - GENERAL

1.01 GENERAL PROVISIONS

A. 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.

1.02 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Joint sealants and fillers.

B. This Section includes joint sealants for the applications specified with the products in this Section and as indicated on Drawings.

C. Related Work: The following items are not included in this Section and are specified under the designated Sections:

1. Section 04200 - UNIT MASONRY for masonry control and expansion joint fillers and gaskets.
2. Section 07545 - THERMOPLASTIC SINGLE-PLY ROOFING for roofing sealants.
3. Section 08800 - GLAZING for glazing sealants.
4. Section 09211 - GYPSUM BOARD ASSEMBLIES for sealing perimeter joints of gypsum board partitions to reduce sound transmission.
5. Section 09510 - ACOUSTICAL CEILINGS for sealing edge moldings at perimeters of acoustical ceilings.

1.03 PERFORMANCE REQUIREMENTS

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

B. Provide joint sealants for interior applications that establish and maintain airtight and water-resistant continuous joint seals without staining or deteriorating joint substrates.

1.04 SUBMITTALS

A. Product Data: For each joint-sealant product indicated.

B. Samples for Verification: For each type and color of joint sealant required, provide Samples with joint sealants in 1/2-inch- wide joints formed between two 6-inch- long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

C. Qualification Data: For Installer.

D. Preconstruction Field Test Reports: Indicate which sealants and joint preparation methods resulted in optimum adhesion to joint substrates based on preconstruction testing specified in "Quality Assurance" Article.

E. Compatibility and Adhesion Test Reports: From sealant manufacturer, indicating the following:

1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
2. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.

F. Field Test Report Log: For each elastomeric sealant application.

G. Product Test Reports: Based on comprehensive testing of product formulations performed by a qualified testing agency, indicating that sealants comply with requirements.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized Installer who is approved or licensed for installation of elastomeric sealants required for this Project.

B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.

C. Preconstruction Compatibility and Adhesion Testing: Submit to joint-sealant manufacturers, for testing indicated below, samples of materials that will contact or affect joint sealants.

1. Use manufacturer's standard test method to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
2. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
3. For materials failing tests, obtain joint-sealant manufacturer's written instructions for corrective measures including use of specially formulated primers.
4. Testing will not be required if joint-sealant manufacturers submit joint preparation data that are based on previous testing of current sealant products for adhesion to, and compatibility with, joint substrates and other materials matching those submitted.

D. Preconstruction Field-Adhesion Testing: Before installing elastomeric sealants, field test their adhesion to Project joint substrates as follows:

1. Locate test joints where indicated on Project or, if not indicated, as directed by Engineer.
2. Conduct field tests for each application indicated below:

    a. Each type of elastomeric sealant and joint substrate indicated.
    b. Each type of nonelastomeric sealant and joint substrate indicated.

3. Notify Engineer seven days in advance of dates and times when test joints will be erected.

    a. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193.

        1) For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.

4. Report whether sealant in joint connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each type of product and joint substrate. For sealants that fail adhesively, retest until satisfactory adhesion is obtained.
5. Evaluation of Preconstruction Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing, in absence of other indications of noncompliance with requirements, will be considered satisfactory. Do not use sealants that fail to adhere to joint substrates during testing.

1.06 PROJECT CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.
2. When joint substrates are wet.
3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
4. Contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.07 WARRANTY

A. Special Installer's Warranty: Installer's standard form in which Installer agrees to repair or replace elastomeric joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

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

B. Special Manufacturer's Warranty: Manufacturer's standard form in which elastomeric sealant manufacturer agrees to furnish elastomeric joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.

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

C. Special warranties specified in this Article exclude deterioration or failure of elastomeric joint sealants from the following:

1. Movement of the structure resulting in stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression caused by structural settlement or errors attributable to design or construction.
2. Disintegration of joint substrates from natural causes exceeding design specifications.
3. Mechanical damage caused by individuals, tools, or other outside agents.
4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.01 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer, based on testing and field experience.

B. VOC Content of Interior Sealants: Provide interior sealants and sealant primers that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

1. Architectural Sealants: 250 g/L.
2. Sealant Primers for Nonporous Substrates: 250 g/L.
3. Sealant Primers for Porous Substrates: 775 g/L.

C. Colors of Exposed Joint Sealants: Provide colors as selected by the Engineer from manufacturer’s full range of standard and custom colors; maximum of five colors, three standard colors and two custom colors.

2.02 JOINT SEALANTS

A. Elastomeric Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied chemically curing sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.

B. Stain-Test-Response Characteristics: Elastomeric sealants shall be nonstaining to porous substrates. Provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.

C. Suitability for Contact with Food: Where elastomeric sealants are indicated for joints that will come in repeated contact with food, provide products that comply with 21 CFR 177.2600.

D. Single-Component Neutral-Curing Silicone Sealant:

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

    a. Dow Corning Corporation; 790.
    b. GE Silicones; SilPruf LM SCS2700.
    c. Tremco Inc.; Spectrem 1.
    d. Pecora Corporation; 864.
    e. Bondaflex Technologies; Sil 290

2. Extent of Use: Joints in exterior vertical and soffit surfaces.

E. Multicomponent Pourable Urethane Sealant:

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

    a. Bostik Findley; Chem-Calk 550.
    b. Meadows, W. R., Inc.; POURTHANE.
    c. Pecora Corporation; Urexpan NR-200.
    d. Tremco Inc.; THC-901.
    e. Bondaflex Technologies; PUR 2 SL

2. Extent of Use: Joints in exterior horizontal surfaces.

F. Single-Component Mildew-Resistant Acid-Curing Silicone Sealant:

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

    a. Dow Corning Corporation; 786 Mildew Resistant.
    b. GE Silicones; Sanitary SCS1700.
    c. Tremco Inc.; Tremsil 200.
    d. Bondaflex Technologies; Sil 100 WF

2. Extent of Use: Sanitary joints at toilet rooms.

G. Latex Sealant: Comply with ASTM C 834, Type P, Grade NF.

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

    a. Bostik Findley; Chem-Calk 600.
    b. Pecora Corporation; AC-20+.
    c. Sonneborn, BASF Building Systems; Sonolac.
    d. Tremco Inc.; Tremflex 834.
    e. May National Bondaflex Sil-A 700

2. Extent of Use: Non-moving joints at interior locations.

2.03 JOINT-SEALANT BACKING

A. General: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Elastomeric Tubing Sealant Backings: Neoprene, butyl, EPDM, or silicone tubing complying with ASTM D 1056, nonabsorbent to water and gas, and capable of remaining resilient at temperatures down to minus 26 deg F. Provide products with low compression set and of size and shape to provide a secondary seal, to control sealant depth, and to otherwise contribute to optimum sealant performance.

C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

2.04 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

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

3.02 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
2. Clean porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include concrete, masonry and unglazed surfaces of ceramic tile.
3. Remove laitance and form-release agents from concrete.
4. Clean nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following metal, glass, porcelain enamel and glazed surfaces of ceramic tile.

B. Joint Priming: Prime joint substrates, where recommended in writing by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.03 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Install sealant backings of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of sealant backings.
2. Do not stretch, twist, puncture, or tear sealant backings.
3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.

D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:

1. Place sealants so they directly contact and fully wet joint substrates.
2. Completely fill recesses in each joint configuration.
3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

1. Remove excess sealant from surfaces adjacent to joints.
2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
3. Provide concave joint configuration per Figure 5A in ASTM C 1193, unless otherwise indicated.

3.04 CLEANING

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

3.05 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

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DIVISION 08

SECTION 08111

HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.01 GENERAL PROVISIONS

A. 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.

1.02 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Galvanized hollow-metal steel doors and frames, including entrance doors and frames with insulated glazed units in the door and clerestory.

2. Refer to drawings for hardware selections.

B. Related Work: The following items are not included in this Section and are specified under the designated Sections:

1. Section 02400 - SELECTIVE DEMOLITION for salvaged bronze hardware to be installed on front door.

2. Section 04200 - UNIT MASONRY for building anchors into and grouting steel frames in masonry construction.
3. Section 08800 - GLAZING for glazed lites.
4. Section 09900 - PAINTING AND COATING for field painting steel doors and frames.

1.03 SUBMITTALS

A. Product Data: Include construction details, material descriptions, core descriptions, label compliance, fire-resistance rating, temperature-rise ratings, and finishes for each type of steel door and frame specified.

B. Shop Drawings:

1. Elevations of each door design.
2. Details of doors, including vertical and horizontal edge details and metal thicknesses.
3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.

4. Locations of reinforcement and preparations for hardware, including the bronze salvaged hardware from the existing doors.
5. Details of each different wall opening condition.
6. Details of anchorages, joints, field splices, and connections.
7. Details of accessories.
8. Details of moldings, removable stops, and glazing.
9. Details of conduit and preparations for power, signal, and control systems.

C. Schedule: Provide a schedule of hollow metal work prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with door hardware schedule.

D. Qualification Data: For Installer.

E. Product Test Reports: Based on evaluation of comprehensive fire tests performed by a qualified testing agency, for each type of standard steel door and frame.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer.

B. Source Limitations: Obtain standard steel doors and frames through one source from a single manufacturer.

C. Fire-Rated Door, Sidelight and Transom Frame Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver doors and frames palletized, wrapped, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Store hollow metal work under cover at Project site. Place in stacks of five units maximum in a vertical position with heads up, spaced by blocking, on minimum 4-inch-high wood blocking. Do not store in a manner that traps excess humidity.

1. Provide minimum 1/4-inch space between each stacked door to permit air circulation.

1.06 PROJECT CONDITIONS

A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.07 COORDINATION

A. Coordinate installation of anchorages for hollow metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

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

1. Amweld Building Products, LLC.
2. Ceco Door Products; an ASSA ABLOY Group Company.
3. CURRIES Company; an ASSA ABLOY Group Company.
4. de LaFontaine
5. Mesker Door Inc.

2.02 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum G60 metallic coating.

D. Frame Anchors: ASTM A 591/A 591M, Commercial Steel (CS), 40Z coating designation; mill phosphatized.

1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M, hot-dip galvanized according to ASTM A 153/A 153M, Class B.

E. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.

F. Powder-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow metal frames of type indicated.

G. Grout: ASTM C 476, except with a maximum slump of 4 inches, as measured according to ASTM C 143/C 143M.

H. Mineral-Fiber Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool with 6- to 12-lb/cu. ft. density; with maximum flame-spread and smoke-development indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.

I. Glazing: Comply with requirements in Section 08800 - GLAZING.

J. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.03 STANDARD STEEL DOORS

A. General: Provide doors of design indicated, not less than thickness indicated; fabricated with smooth surfaces, without visible joints or seams on exposed faces, unless otherwise indicated. Comply with ANSI A250.8.

1. Design: Flush panel.
2. Core Construction: Manufacturer's standard kraft-paper honeycomb, polystyrene, polyurethane, mineral-board, or vertical steel-stiffener core that produces doors complying with ANSI A250.8.
    a. Fire Door Core: As required to provide fire-protection and temperature-rise ratings indicated.
    b. Thermal-Rated (Insulated) Exterior Doors: Where indicated, provide doors fabricated with thermal-resistance value (R-value) of not less than 4.0 deg F x h x sq. ft./Btu when tested according to ASTM C 1363.
3. Top and Bottom Edges: Closed with flush or inverted 0.042-inch-thick end closures or channels of same material as face sheets.
4. Tolerances: Comply with SDI 117, "Manufacturing Tolerances for Standard Steel Doors and Frames."

B. Exterior and Interior Doors: Face sheets fabricated from metallic-coated steel sheet. Provide doors complying with requirements indicated below by referencing ANSI A250.8 for level and model and ANSI A250.4 for physical-endurance level:

1. Level 4 and Physical Performance Level A (Maximum Duty), Model 2 (Seamless), 1-3/4 inches thick.

C. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.

D. Fabricate concealed stiffeners and hardware reinforcement from either cold- or hot-rolled steel sheet.

2.04 STANDARD STEEL FRAMES

A. General: Comply with ANSI A250.8 and with details indicated for type and profile.

B. Exterior and Interior Frames: Fabricated from metallic-coated steel sheet. Form to profiles indicated on the Drawings; typically flush to face of CMU with double rabbet.

1. Fabricate frames with full profile welded joints.
2. Frames for Level 4 Steel Doors: 0.067-inch-thick steel sheet.

C. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 with reinforcement plates from same material as frames.

2.05 FRAME ANCHORS

A. Jamb Anchors:

1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.042 inch thick, with corrugated or perforated straps not less than 2 inches wide by 10 inches long; or wire anchors not less than 0.177 inch thick.
2. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch thick.
3. Compression Type for Drywall Slip-on Frames: Adjustable compression anchors.
4. Postinstalled Expansion Type for In-Place Concrete or Masonry: Minimum 3/8-inch- diameter bolts with expansion shields or inserts. Provide pipe spacer from frame to wall, with throat reinforcement plate, welded to frame at each anchor location.

B. Floor Anchors: Formed from same material as frames, not less than 0.042 inch (1.0 mm) thick, and as follows:

1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.
2. Separate Topping Concrete Slabs: Adjustable-type anchors with extension clips, allowing not less than 2-inch height adjustment. Terminate bottom of frames at finish floor surface.

2.06 HOLLOW METAL PANELS

A. Provide hollow metal panels of same materials, construction, and finish as specified for adjoining hollow metal work.

2.07 STOPS AND MOLDINGS

A. Moldings for Glazed Lites in Doors: Minimum 0.032 inch thick, fabricated from same material as door face sheet in which they are installed.

B. Fixed Frame Moldings: Formed integral with hollow metal frames, a minimum of 5/8 inch high unless otherwise indicated.

C. Loose Stops for Glazed Lites in Frames: Minimum 0.032 inch thick, fabricated from same material as frames in which they are installed.

2.08 ACCESSORIES

A. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.

B. Ceiling Struts: Minimum 1/4-inch-thick by 1-inch-wide steel.

C. Grout Guards: Formed from same material as frames, not less than 0.016 inch thick.

2.09 FABRICATION

A. Fabricate hollow metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.

B. Tolerances: Fabricate hollow metal work to tolerances indicated in SDI 117.

C. Hollow Metal Doors:

1. Exterior Doors: Provide weep-hole openings in bottom of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.
2. Glazed Lites: Factory cut openings in doors.
3. Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch beyond edge of door on which astragal is mounted.

D. Hollow Metal Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.

1. Full Profile Welded Frames: Weld joints continuously; grind, fill, dress, and make smooth, flush, and not visible.
2. Sidelight and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as doorframe. Fasten members at crossings and to jambs by butt welding.
3. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
4. Grout Guards: Weld guards to frame at back of hardware mortises in frames to be grouted.
5. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
6. Jamb Anchors: Provide number and spacing of anchors as follows:

a. Masonry Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:

1) Two anchors per jamb up to 60 inches high.
2) Three anchors per jamb from 60 to 90 inches high.
3) Four anchors per jamb from 90 to 120 inches high.
4) Four anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 120 inches high.

b. Stud-Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:

1) Three anchors per jamb up to 60 inches high.
2) Four anchors per jamb from 60 to 90 inches high.
3) Five anchors per jamb from 90 to 96 inches high.
4) Five anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.
5) Two anchors per head for frames above 42 inches wide and mounted in metal-stud partitions.

c. Compression Type: Not less than two anchors in each jamb.
d. Postinstalled Expansion Type: Locate anchors not more than 6 inches from top and bottom of frame. Space anchors not more than 26 inches o.c.

7. Door Silencers: Except on weather-stripped doors, drill stops to receive door silencers as follows. Keep holes clear during construction.

a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.

E. Fabricate concealed stiffeners, edge channels, and hardware reinforcement from either cold- or hot-rolled steel sheet.

F. Hardware Preparation: Factory prepare hollow metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door Hardware Schedule and templates furnished. Refer to drawings for hardware types and schedule.

1. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8.
2. Reinforce doors and frames to receive nontemplated, mortised and surface-mounted door hardware.
3. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.

4. Coordinate locations of conduit and wiring boxes for electrical connections with Division 16 - ELECTRICAL.

G. Stops and Moldings: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints.

1. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of hollow metal work.
2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.
4. Provide loose stops and moldings on inside of hollow metal work.
5. Coordinate rabbet width between fixed and removable stops with type of glazing and type of installation indicated.

2.10 STEEL FINISHES

A. Prime Finish: Apply manufacturer's standard epoxy primer immediately after cleaning and pretreating.

1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI/SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.
2. Refer to Section 09900 – PAINTING AND COATING for field-applied coating.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for embedded and built-in anchors to verify actual locations before frame installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.

B. Prior to installation, adjust and securely brace welded hollow metal frames for squareness, alignment, twist, and plumbness to the following tolerances:

1. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
2. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
3. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
4. Plumbness: Plus or minus 1/16 inch, measured at jambs on a perpendicular line from head to floor.

C. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.03 INSTALLATION

A. General: Install hollow metal work plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.

B. Hollow Metal Frames: Install hollow metal frames of size and profile indicated. Comply with ANSI/SDI A250.11.

1. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.

a. At fire-protection-rated openings, install frames according to NFPA 80.
b. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
c. Install frames with removable glazing stops located on secure side of opening.
d. Install door silencers in frames before grouting.
e. Remove temporary braces necessary for installation only after frames have been properly set and secured.
f. Check plumbness, squareness, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
g. Field apply bituminous coating to backs of frames that are filled with grout.

2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.

a. Floor anchors may be set with powder-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.

3. Metal-Stud Partitions: Solidly pack mineral-fiber insulation behind frames.
4. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout.
5. Concrete Walls: Solidly fill space between frames and concrete with grout. Take precautions, including bracing frames, to ensure that frames are not deformed or damaged by grout forces.
6. In-Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
7. In-Place Gypsum Board Partitions: Secure frames in place with postinstalled expansion anchors through floor anchors at each jamb. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
8. Ceiling Struts: Extend struts vertically from top of frame at each jamb to overhead structural supports or substrates above frame unless frame is anchored to masonry or to other structural support at each jamb. Bend top of struts to provide flush contact for securing to supporting construction. Provide adjustable wedged or bolted anchorage to frame jamb members.
9. Installation Tolerances: Adjust hollow metal door frames for squareness, alignment, twist, and plumb to the following tolerances:

    a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
    b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
    c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
    d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.

C. Hollow Metal Doors: Fit hollow metal doors accurately in frames, within clearances specified below. Shim as necessary.

1. Non-Fire-Rated Standard Steel Doors:

    a. Jambs and Head: 1/8 inch plus or minus 1/16 inch.
    b. Between Edges of Pairs of Doors: 1/8 inch plus or minus 1/16 inch .
    c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch.
    d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch.

2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
3. Smoke-Control Doors: Install doors according to NFPA 105.

D. Glazing: Comply with hollow metal manufacturer's written instructions.

1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches o.c. and not more than 2 inches o.c. from each corner.

3.04 ADJUSTING AND CLEANING

A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow metal work that is warped, bowed, or otherwise unacceptable.

B. Remove grout and other bonding material from hollow metal work immediately after installation.

C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.

D. Metallic-Coated Surfaces: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

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SECTION 08311

ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.01 GENERAL PROVISIONS

A. 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.

1.02 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Access doors and frames for walls and ceilings.

B. Related Work: The following items are not included in this Section and are specified under the designated Sections:

1. Section 03300 - CAST-IN-PLACE CONCRETE for blocking out openings for access doors and frames in concrete.
2. Section 04200 - UNIT MASONRY for anchoring and grouting access door frames set in masonry construction.

1.03 SUBMITTALS

A. Product Data: For each type of access door and frame indicated. Include construction details, fire ratings, materials, individual components and profiles, and finishes.

B. Shop Drawings: Show fabrication and installation details of access doors and frames for each type of substrate. Include plans, elevations, sections, details, and attachments to other work.

C. Samples: For each door face material, at least 3 by 5 inches in size, in specified finish.

D. Access Door and Frame Schedule: Provide complete access door and frame schedule, including types, locations, sizes, latching or locking provisions, and other data pertinent to installation.

E. Ceiling Coordination Drawings: Reflected ceiling plans, drawn to scale, on which ceiling-mounted items including access doors and frames, lighting fixtures, diffusers, grilles, speakers, sprinklers, and special trim are shown and coordinated with each other.

1.04 QUALITY ASSURANCE

A. Source Limitations: Obtain[each type of access door and frame through one source from a single manufacturer.

B. Fire-Rated Access Doors and Frames: Units complying with NFPA 80 that are identical to access door and frame assemblies tested for fire-test-response characteristics per the following test method and that are listed and labeled by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:

1. NFPA 252 for vertical access doors and frames.
2. ASTM E 119 for horizontal access doors and frames.

C. Size Variations: Obtain Engineer's acceptance of manufacturer's standard-size units, which may vary slightly from sizes indicated.

1.05 COORDINATION

A. Verification: Determine specific locations and sizes for access doors needed to gain access to concealed plumbing, mechanical, or other concealed work, and indicate in the schedule specified in "Submittals" Article.

PART 2 - PRODUCTS

2.01 STEEL MATERIALS

A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

1. ASTM A 123/A 123M, for galvanizing steel and iron products.
2. ASTM A 153/A 153M, for galvanizing steel and iron hardware.

B. Steel Sheet: Electrolytic zinc-coated, ASTM A 879/A 879M with cold-rolled steel sheet substrate complying with ASTM A 1008/A 1008M, Commercial Steel (CS), exposed.

C. Steel Finishes: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Surface Preparation for Steel Sheet: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning," to remove dirt, oil, grease, or other contaminants that could impair paint bond. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning," or SSPC-SP 8, "Pickling."

a. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.

2. Factory-Primed Finish: Apply shop primer immediately after cleaning and pretreating.

D. Drywall Beads: Edge trim formed from 0.0299-inch zinc-coated steel sheet formed to receive joint compound and in size to suit thickness of gypsum board.

2.02 STAINLESS-STEEL MATERIALS

A. Rolled-Stainless-Steel Floor Plate: ASTM A 793, manufacturer's standard finish.

B. Stainless-Steel Sheet, Strip, Plate, and Flat Bars: ASTM A 666, Type 316. Remove tool and die marks and stretch lines or blend into finish.

1. Finish: Directional Satin Finish, No. 4.

2.03 ACCESS DOORS AND FRAMES FOR WALLS AND CEILINGS

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

1. Acudor Products, Inc.
2. Babcock-Davis; A Cierra Products Co.
3. Dur-Red Products.
4. J. L. Industries, Inc.
5. Karp Associates, Inc.
6. Larsen's Manufacturing Company.
7. Milcor Inc.
8. Nystrom, Inc.

B. Flush Access Doors and Trimless Frames: Fabricated from steel sheet at typical areas and from stainless-steel sheet at toilet and wet areas.

1. Locations: Wall and ceiling surfaces.
2. Door: Minimum 0.060-inch-thick sheet metal, set flush with surrounding finish surfaces.
3. Frame: Minimum 0.060-inch-thick sheet metal with drywall bead flange.
4. Hinges: Continuous piano.
5. Lock: Cylinder, to match Owner’s key system.

a. Lock Preparation: Prepare door panel to accept cylinder.

C. Recessed Access Doors and Trimless Frames: Fabricated from steel sheet at typical areas and from stainless-steel sheet at toilet and wet areas.

1. Locations: Wall and ceiling surfaces.
2. Door: Minimum 0.060-inch-thick sheet metal in the form of a pan recessed 5/8 inch for gypsum board infill.

3. Frame: Minimum 0.060-inch-thick sheet metal with drywall bead for gypsum board surfaces.
4. Hinges: Concealed pivoting rod hinge.
5. Lock: Cylinder.

    a. Lock Preparation: Prepare door panel to accept cylinder.

D. Fire Rated, Uninsulated, Flush Access Doors and Frames with Exposed Trim: Fabricated from steel at typical areas and from stainless-steel sheet at toilets and wet areas.

1. Locations: Wall surfaces.
2. Fire-Resistance Rating: Not less than that of adjacent construction.
3. Door: Minimum 0.060-inch-thick sheet metal, flush construction.
4. Frame: Minimum 0.060-inch-thick sheet metal with 1-inch-wide, surface-mounted trim.
5. Hinges: Continuous piano.
6. Automatic Closer: Spring type.
7. Lock: Self-latching device with cylinder lock.

    a. Lock Preparation: Prepare door panel to accept cylinder.

2.04 FABRICATION

A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.

B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.

C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure access panels to types of supports indicated.

1. For trimless frames with drywall bead, provide edge trim for gypsum board and gypsum base securely attached to perimeter of frames.
2. For trimless frames with plaster bead for full-bed plaster applications, provide zinc-coated expanded metal lath and exposed casing bead welded to perimeter of frames.
3. Provide mounting holes in frames for attachment of units to metal or wood framing.
4. Provide mounting holes in frame for attachment of masonry anchors.

D. Recessed Access Doors: Form face of panel to provide recess for application of applied finish. Reinforce panel as required to prevent buckling.

1. For recessed doors with plaster infill, provide self-furring expanded metal lath attached to door panel.

E. Latching Mechanisms: Furnish number required to hold doors in flush, smooth plane when closed.

1. For cylinder lock, furnish two keys per lock and key all locks alike.
2. For recessed panel doors, provide access sleeves for each locking device. Furnish plastic grommets and install in holes cut through finish.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Comply with manufacturer's written instructions for installing access doors and frames.

B. Set frames accurately in position and attach securely to supports with plane of face panels aligned with adjacent finish surfaces.

C. Install doors flush with adjacent finish surfaces or recessed to receive finish material.

3.02 ADJUSTING AND CLEANING

A. Adjust doors and hardware after installation for proper operation.

B. Remove and replace doors and frames that are warped, bowed, or otherwise damaged.

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SECTION 08510

STEEL WINDOWS

PART 1 - GENERAL

1.01 GENERAL PROVISIONS

A. 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.

1.02 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
   1. Fixed and project-out cold-formed steel-framed windows, trim, anchors, factory applied finishes with factory-installed glass and glazing.

B. Related Work: The following items are not included in this Section and are specified under the designated Sections:

   1. Section 05500 – METAL FABRICATIONS for miscellaneous structural items.
   2. Section 07920 – JOINT SEALANTS for perimeter applied finishes on wood
   3. Section 08800 - GLAZING for glass and glazing.

1.03 PERFORMANCE REQUIREMENTS

A. General: Provide steel windows capable of complying with performance requirements indicated, based on testing manufacturer's windows that are representative of those specified and that are of test size indicated below:
   1. Minimum size required by AAMA/NWWDA 101/I.S.2.

B. AAMA/NWWDA Performance Requirements: Provide steel windows of the performance class and grade indicated that comply with AAMA/NWWDA 101/I.S.2.
   1. Performance Class: Architectural Grade AW.
   2. Performance Grade: Minimum for performance class indicated.
   3. Exception to AAMA/NWWDA 101/I.S.2: In addition to requirements for performance class and performance grade, design glass framing system to limit lateral deflections of glass edges to less than 1/175 of glass-edge length or 3/4 inch whichever is less, at design pressure based on the following:

C. Structural Performance: Provide steel windows capable of withstanding the following, including wind loads based on passing AAMA/NWWDA 101/I.S.2, Uniform Load Structural Test, at basic wind speed indicated and as required by Code:

1. Deflection: Design glass framing system to limit lateral deflections of glass edges to less than 1/175 of glass-edge length or 3/4 inch, whichever is less, at design pressure based on structural computations.
2. Wind and Seismic Loads: As indicated on the Structural Drawings, but not less than that required by Code.
3. Movements of supporting structure including, but not limited to, story drift and deflection from uniformly distributed and concentrated live loads as required by Code. Deflection may require special considerations including but not limited to head receptors.

D. Air Infiltration: Maximum rate not more than indicated when tested according to ASTM E283-04 (2012) or NFRC, Air Infiltration Test.
1. Maximum Rate: 0.3 inch water gauge (75 Pa) as required by Code.

E. Water Resistance: No water leakage as defined in AAMA/NWWDA referenced test methods at a water test pressure equaling that indicated, when tested according to AAMA/NWWDA 101/I.S.2, Water Resistance Test.
1. Test Pressure: 15 percent of positive design pressure, but not less than 2.86 lbf/sq. ft. or more than 12 lbf/sq. ft.

F. Condensation-Resistance Factor: Provide steel windows tested for thermal performance according to AAMA 1503, showing a CRF of 52 where windows are indicated to be "thermally improved."

G. Thermal Transmittance: Provide steel windows with a whole-window U-value maximum indicated at 15-mph exterior wind velocity and winter condition temperatures when tested according to AAMA 1503.
1. U-Value: As required by Code. Submit proof of compliance with submittals as specified.
2. SHGC: As required by Code.

H. Thermal Movements: Provide steel windows, including anchorage, that accommodate thermal movements of units resulting from the following maximum change (range) in ambient and surface temperatures without buckling, distortion, opening of joints, failure of joint sealants, damaging loads and stresses on glazing and connections, and other detrimental effects. Base engineering calculation on actual surface temperatures of materials due to solar heat gain and nighttime-sky heat loss.
1. Temperature Change (Range): 120 deg F, ambient; 180 deg F material surfaces.

I. Laminated specification: Provide steel windows that break safely with 150 lb impact as defined by the Consumer Product Safety Commission (CPSC) 16 CFR 1201 standard

1.04 SUBMITTALS

A. Product Data: Include construction details, material descriptions, fabrication methods, dimensions of individual components and profiles, hardware, finishes, and operating instructions for each type of steel window indicated.

B. Shop Drawings: Include plans, elevations, sections, details, hardware, attachments to other Work, operational clearances, and the following:
   1. Mullion details, including reinforcement and stiffeners.
   2. Joinery details.
   3. Expansion provisions.
   4. Flashing and drainage details.
   5. Weather-stripping details.
   6. Thermal-break details.
   7. Glazing details.
   8. Window cleaning provisions.
   9. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation and used to determine the following:
      a. Structural test pressures and design pressures from basic wind speeds indicated.
      b. Deflection limitations of glass framing systems.

C. Samples for Verification: corner lower operable sash and frame of window.

D. Qualification Data: For Installer, professional engineer and testing agency.

E. Field Quality-Control Test Reports: From a qualified testing and inspecting agency engaged by Contractor.

F. Product Test Reports: Based on evaluation of comprehensive tests performed within the last four years by a qualified testing agency, for each type, grade, and size of steel window. Test results based on use of downsized test units will not be accepted.

G. Performance Reports: Based on systems, components and glazing methods proposed for use on this Project, proof that windows as glazed for this Project meet or exceed Code requirements for the following:
   1. U-value.
   2. Solar heat-gain coefficient.

H. Maintenance Data: For window finishes to include in maintenance manuals.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: An installer acceptable to steel window manufacturer for installation of units required for this Project.

B. Engineering Responsibility: Preparation of Shop Drawings, design calculations, and other structural data by a qualified professional engineer.

C. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in the state the project is located, and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those

performed for installations of windows that are similar to those indicated for this Project in material, design, and extent.

D. Source Limitations: Obtain steel windows through one source from a single manufacturer.

E. Product Options: Information on Drawings and in Specifications establishes requirements for steel windows' aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including preconstruction testing, field testing, and in-service performance.

F. Glazing Publications: Comply with published recommendations of glass manufacturers and GANA's "Glazing Manual" unless more stringent requirements are indicated.

G. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

H. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01. Review methods and procedures related to steel windows including, but not limited to, the following:
   1. Inspect and discuss condition of substrate and other preparatory work performed by other trades.
   2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
   3. Review required testing and inspecting procedures.

1.06 PROJECT CONDITIONS

A. Field Measurements: Verify steel window openings by field measurements before fabrication and indicate measurements on Shop Drawings.
   1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish opening dimensions and proceed with fabricating steel windows without field measurements. Coordinate wall construction to ensure that actual opening dimensions correspond to established dimensions.

1.07 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace steel windows that fail in materials or workmanship within specified warranty period. Failures include, but are not limited to, the following:
   1. Failure to meet performance requirements.
   2. Structural failures including excessive deflection.
   3. Water leakage, air infiltration, or condensation.
   4. Faulty operation of movable sash and hardware.

5. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
6. Insulating glass failure.

B. Warranty Period: Ten years from date of Substantial Completion.

C. Warranty Period for Metal Finishes: Ten years from date of Substantial Completion.

D. Warranty Period for Glass: Ten years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Steel Windows:
   a. HOPE'S WINDOWS, INC. P.O. Box. 580 Jamestown, NY 14702 716-665-5124 www.hopeswindows.com .
   b. Brombal represented in USA by Steel Windows & Doors USA 690 Surf Avenue Stratford, CT 06615. Phone: 203-579-5157 http://www.steelwindowsanddoors.com/
   c. Optimum Window Manufacturing Corp of Ellenville, NY. www.optimumwindow.com .
   d. Bliss Nor Am Steel Windows & Doors of Jamesville, NY www.blissnoram.com .

2.02 MATERIALS

A. Steel Extrusions: Alloy and temper recommended by steel window manufacturer for strength, corrosion resistance, and application of required finish, but not less than 22,000-psi (150-MPa) ultimate tensile strength, not less than 16,000-psi (110-MPa) minimum yield strength, and not less than 0.062-inch (1.6-mm) thickness at any location for the main frame and sash members.

B. Fasteners: Nonmagnetic stainless steel, epoxy adhesive, or other materials warranted by manufacturer to be noncorrosive and compatible with steel window members, trim, hardware, anchors, and other components.
1. Reinforcement: Where fasteners screw anchor into steel less than 0.125 inch (3.2 mm) thick, reinforce interior with nonmagnetic stainless steel to receive screw threads, or provide standard, noncorrosive, pressed-in, splined grommet nuts.
2. Exposed Fasteners: Unless unavoidable for applying hardware, do not use exposed fasteners. For application of hardware, use fasteners that match finish of member or hardware being fastened, as appropriate.

C. Anchors, Clips, and Accessories: nonmagnetic stainless steel, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions; provide sufficient strength to withstand design pressure indicated.

D. Reinforcing Members: nonmagnetic stainless steel, or nickel/chrome-plated steel complying with ASTM B 456 for Type SC 3 severe service conditions, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions; provide sufficient strength to withstand design pressure indicated.

E. Sealant: For sealants required within fabricated windows, provide window manufacturer's standard, permanently elastic, nonshrinking, and nonmigrating type recommended by sealant manufacturer for joint size and movement.

2.03 GLAZING

A. Laminated Insulating-Glass Units for Vertical Glazing (IGU-1): 1-1/4 inch thick laminated insulating glass consisting of one lite of 9/16" laminated glass and one lite of 1/4 inch glass, low e coating on the No. 4 surface and argon gas filled. Provide one of the following or equal:
   1. VE-42 by Viracon.
      a. Visible Light Transmittance: 36 percent.
      b. U Value (Winter): 0.30.
      c. Solar Heat Gain Coefficient: 0.29.
   2. Approved equal by PPG Industries.
   3. Approved equal by Guardian Industries.

B. Translucent Laminated Insulating-Glass Units (IGU-2): Provide insulating glass units as specified hereinabove except with a translucent laminated outer lite.

C. Glazing System: Manufacturer's standard factory-glazing system that produces weathertight seal.

D. Refer to Section 08800 – Glazing for additional requirements.

2.04 FABRICATION

A. General: Fabricate steel windows, in sizes indicated, that comply with AAMA/NWWDA 101/I.S.2 for performance class and performance grade indicated. Include a complete system for assembling components and anchoring windows.

B. Thermally Improved Construction: Fabricate steel windows with an integral, concealed, low-conductance thermal barrier; located between exterior materials and window members exposed on interior side; in a manner that eliminates direct metal-to-metal contact.

C. Weather Stripping: Provide full-perimeter weather stripping for each operable sash and ventilator.

D. Weep Holes: Provide concealed weep holes and internal passages to conduct infiltrating water to exterior.

E. Mullions: Provide mullions and cover plates as shown, matching window units, complete with anchors for support to structure and installation of window units. Allow for erection tolerances and provide for movement of window units due to thermal expansion and building deflections, as indicated. Provide mullions and cover plates capable of withstanding design loads of window units.

F. Factory-Glazed Fabrication: Glaze steel windows in the factory where practical and possible for applications indicated. Comply with AAMA/NWWDA 101/I.S.2.

G. Window Panning: Provide custom window panning profiles. Refer to drawings for shapes.

2.05 FINISHES

A. General: Comply with NAAM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. High-Performance Organic Finish: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid-chromate-fluoride-phosphate conversion coating; Organic Coating: as specified below). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
   1. Fluoropolymer Three-Coat System: Manufacturer's standard three-coat, thermocured system consisting of specially formulated inhibitive primer, fluoropolymer color coat, and clear fluoropolymer topcoat, with both color coat and clear topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with AAMA 2605.
   2. Color and Gloss: As selected by Engineer from manufacturer's full range.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances; rough opening dimensions; levelness of sill plate; coordination with wall flashings, vapor retarders, and other built-in components; operational clearances; and other conditions affecting performance of work.
   1. Masonry Surfaces: Visibly dry and free of excess mortar, sand, and other construction debris.
   2. Metal Surfaces: Dry; clean; free of grease, oil, dirt, rust, corrosion, and welding slag; without sharp edges or offsets at joints.

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

3.02 INSTALLATION

A. General: Comply with manufacturer's written instructions for installing windows, hardware, accessories, and other components; Drawings; and Shop Drawings.

B. Install windows level, plumb, square, true to line, without distortion or impeding thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction.

C. Set sill members in bed of sealant or with gaskets, as indicated, for weathertight construction.

D. Install windows and components to drain condensation, water penetrating joints, and moisture migrating within windows to the exterior.

E. Metal Protection: Separate steel and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials by complying with requirements specified in "Dissimilar Materials" Paragraph in Appendix B in AAMA/NWWDA 101/I.S.2.

3.03 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified independent testing and inspecting agency to perform field tests and inspections and to prepare test reports.

B. Testing Services: Testing and inspecting of installed windows shall take place as follows:
   1. Testing Methodology: Testing of windows for air infiltration and water resistance shall be performed according to AAMA 502, Test Method A, by applying same Test pressures required to determine compliance with AAMA/NWWDA 101/I.S.2 in Part 1 "Performance Requirements" Article.
   2. Testing Extent: Three windows as selected by Engineer and a qualified independent testing and inspecting agency. Windows shall be tested immediately after installation.
   3. Test Reports: Shall be prepared according to AAMA 502.

C. Remove and replace windows where test results indicate that they do not comply with specified requirements.

D. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.04 ADJUSTING

A. Adjust operating sashes and ventilators, screens, hardware, operators, and accessories for a tight fit at contact points and weather stripping for smooth operation and weathertight closure. Lubricate hardware and moving parts.

3.05 PROTECTION AND CLEANING

A. Protect window surfaces from contact with contaminating substances resulting from construction operations. In addition, monitor window surfaces adjacent to and below exterior concrete and masonry surfaces during construction for presence of dirt, scum, alkaline deposits, stains, or other contaminants. If contaminating substances do contact window surfaces, remove contaminants immediately according to manufacturer's written recommendations.

B. Clean steel surfaces immediately after installing windows. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.

C. Clean factory-glazed glass immediately after installing windows. Comply with manufacturer's written recommendations for final cleaning and maintenance. Remove nonpermanent labels and clean surfaces.

D. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

END OF SECTION

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SECTION 08710

DOOR HARDWARE

PART 1 - GENERAL

1.01 GENERAL PROVISIONS

A. 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.

1.02 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Door Hardware

B. Related Work: The following items are not included in this Section and are specified under the designated Sections:

1. Section 02400 - SELECTIVE DEMOLITION for salvaged bronze hardware to be installed on front door.

2. Section 04200 - UNIT MASONRY for building anchors into and grouting steel frames in masonry construction.

3. Section 08111 – HOLLOW METAL DOORS AND FRAMES to coordinate hardware for doors and frames.
4. Section 08510 – STEEL WINDOWS AND DOORS to coordinate entrance door transom lite insert with steel window manufacturer.
5. Section 08800 - GLAZING for glazed lites.
6. Section 09900 - PAINTING AND COATING for field painting steel doors and frames.
7. Division 28 Section INTRUSION DETECTION for detection devices installed at door openings and provided as part of an intrusion-detection system.

1.03 SUBMITTALS

Product Data: Product data including manufacturers' technical product data for each item of door hardware, installation instructions, maintenance of operating parts and finish, and other information necessary to show compliance with requirements.

Samples for Verification: As requested by Architect, submit production sample or sample installations of each type of exposed hardware unit in finish indicated, and tagged with full description for coordination with schedule.

1. Samples will be returned to supplier in like-new condition. Units that are acceptable to Architect may, after final check of operations, be incorporated into Work, within limitations of key coordination requirements.

2. Door Hardware Schedule: Submit schedule with hardware sets in vertical format as illustrated by Sequence of Format for the Hardware Schedule as published by the Door and Hardware Institute. Indicate complete designations of each item required for each door or opening, include:
   a. Door Index; include door number, heading number, and Architects hardware set number.
   b. Opening Lock Function Spreadsheet: List locking device and function for each opening.
   c. Type, style, function, size, and finish of each hardware item.
   d. Name and manufacturer of each item.
   e. Fastenings and other pertinent information.
   f. Location of each hardware set cross-referenced to indications on Drawings.
   g. Explanation of all abbreviations, symbols, and codes contained in schedule.
   h. Mounting locations for hardware.
   i. Door and frame sizes and materials.
   j. Name and phone number for local manufacturer's representative for each product.
   k. Operational Description of openings with any electrified hardware (locks, exits, electromagnetic locks, electric strikes, automatic operators, door position switches, magnetic holders or closer/holder units, and access control components). Operational description should include how door will operate on egress, ingress, and fire and smoke alarm connection.
      1. Submittal Sequence: Submit door hardware schedule concurrent with submissions of Product Data, Samples, and Shop Drawings. Coordinate submission of door hardware schedule with scheduling requirements of other work to facilitate fabrication of other work that is critical in Project construction schedule.

B. Key Schedule:

1. After Keying Conference, provide keying schedule listing levels of keying as well as explanation of key system's function, key symbols used and door numbers controlled.
2. Use ANSI A156.28 “Recommended Practices for Keying Systems” as guideline for nomenclature, definitions, and approach for selecting optimal keying system.
3. Provide 3 copies of keying schedule for review prepared and detailed in accordance with referenced DHI publication. Include schematic keying diagram and index each key to unique door designations.
4. Index keying schedule by door number, keyset, hardware heading number, cross

keying instructions, and special key stamping instructions.

5. Provide one complete bitting list of key cuts and one key system schematic illustrating system usage and expansion.
    a. Forward bitting list, key cuts and key system schematic directly to Owner, by means as directed by Owner.
6. Prepare key schedule by or under supervision of supplier, detailing Owner's final keying instructions for locks.
7. Templates: After final approval of hardware schedule, provide templates for doors, frames and other work specified to be factory prepared for door hardware installation.

C. Informational Submittals:
    1. Qualification Data: For Supplier, Installer and Architectural Hardware Consultant.
    2. Product Certificates for electrified door hardware, signed by manufacturer:
        a. Certify that door hardware approved for use on types and sizes of labeled fire-rated doors complies with listed fire-rated door assemblies.
    3. Certificates of Compliance:
        a. Certificates of compliance for fire-rated hardware and installation instructions if requested by Architect or Authority Having Jurisdiction.
        b. Installer Training Meeting Certification: Letter of compliance, signed by Contractor, attesting to completion of installer training meeting specified in "QUALITY ASSURANCE" article, herein.

        Product Test Reports: For compliance with accessibility requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by qualified testing agency, for door hardware on doors located in accessible routes.
    4. Warranty: Special warranty specified in this Section.

D. Closeout Submittals:
    1. Operations and Maintenance Data: Provide in accordance with Division 01 and include:
        a. Complete information on care, maintenance, and adjustment; data on repair and replacement parts, and information on preservation of finishes.
        b. Catalog pages for each product.
        c. Name, address, and phone number of local representatives for each manufacturer.
        d. Parts list for each product.
        e. Final approved hardware schedule edited to reflect conditions as installed.
        f. Final keying schedule
        g. Copies of floor plans with keying nomenclature
        h. As-installed wiring diagrams for each opening connected to power, both low voltage and 110 volts. (as required)
        i. Copy of warranties including appropriate reference numbers for manufacturers to identify project.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer.

B. Source Limitations: Obtain standard hardware through one source from a single manufacturer.

C. Product Substitutions: Comply with product requirements stated in Division 01 and as specified herein.

1. Where specific manufacturer's product is named and accompanied by "No Substitute," including make or model number or other designation, provide product specified. (Note: Certain products have been selected for their unique characteristics and particular project suitability.)

    a. Where no additional products or manufacturers are listed in product category, requirements for "No Substitute" govern product selection.

2. Where products indicate "acceptable substitute" or "acceptable manufacturer", provide product from specified manufacturers, subject to compliance with specified requirements and "Single Source Responsibility" requirements stated herein.

D. Supplier Qualifications and Responsibilities: Recognized architectural hardware supplier with record of successful in-service performance for supplying door hardware similar in quantity, type, and quality to that indicated for this Project and that provides certified Architectural Hardware Consultant (AHC) available to Owner, Architect, and Contractor, at reasonable times during the Work for consultation.

1. Warehousing Facilities: In Project's vicinity.

2. Scheduling Responsibility: Preparation of door hardware and keying schedules.

3. Engineering Responsibility: Preparation of data for electrified door hardware, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.

4. Coordination Responsibility: Coordinate installation of electronic security hardware with Architect and electrical engineers and provide installation and technical data to Architect and other related subcontractors.

    a. Upon completion of electronic security hardware installation, inspect and verify that all components are working properly.

E. Installer Qualifications: Qualified tradesmen, skilled in application of commercial grade hardware with record of successful in-service performance for installing door hardware similar in quantity, type, and quality to that indicated for this Project.

F. Architectural Hardware Consultant Qualifications: Person who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project and meets these requirements:

1. For door hardware, DHI-certified, Architectural Hardware Consultant (AHC).
2. Can provide installation and technical data to Architect and other related subcontractors.
3. Can inspect and verify components are in working order upon completion of installation.
4. Capable of producing wiring diagrams.
5. Capable of coordinating installation of electrified hardware with Architect and electrical engineers.

G. Single Source Responsibility: Obtain each type of door hardware from single manufacturer.
1. Provide electrified door hardware from same manufacturer as mechanical door hardware, unless otherwise indicated.
2. Manufacturers that perform electrical modifications and that are listed by testing and inspecting agency acceptable to authorities having jurisdiction are acceptable.

H. Fire-Rated Door Openings: Provide door hardware for fire-rated openings that complies with NFPA 80 and requirements of authorities having jurisdiction. Provide only items of door hardware that are listed and are identical to products tested by Underwriters Laboratories, Intertek Testing Services, or other testing and inspecting organizations acceptable to authorities having jurisdiction for use on types and sizes of doors indicated, based on testing at positive pressure and according to NFPA 252 or UL 10C and in compliance with requirements of fire-rated door and door frame labels.

I. Means of Egress Doors: Latches do not require more than 15 lbf (67 N) to release latch. Locks do not require use of key, tool, or special knowledge for operation.

J. Accessibility Requirements: For door hardware on doors in an accessible route, comply with governing accessibility regulations cited in "REFERENCES" article, herein.

1. Provide operating devices that do not require tight grasping, pinching, or twisting of wrist and that operate with force of not more than 5 lbf (22.2 N).
2. Maximum opening-force requirements:
    a. Interior, Non-Fire-Rated Hinged Doors: 5 lbf (22.2 N) applied perpendicular to door.
    b. Sliding or Folding Doors: 5 lbf (22.2 N) applied parallel to door at latch.
    c. Fire Doors: Minimum opening force allowable by authorities having jurisdiction.
3. Bevel raised thresholds with slope of not more than 1:2. Provide thresholds not more than 1/2 inch (13 mm) high.
4. Adjust door closer sweep periods so that, from open position of 70 degrees, door will take at least 3 seconds to move to 3 inches (75 mm) from latch, measured to leading edge of door.

K. Keying Conference: Conduct conference at Project site to comply with requirements in Division 01.
   1. Attendees: Owner, Contractor, Architect, and Supplier's Architectural Hardware Consultant.
   2. Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system including:
      a. Function of building, flow of traffic, purpose of each area, degree of security required, and plans for future expansion.
      b. Preliminary key system schematic diagram.
      c. Requirements for key control system.
      d. Requirements for access control.
      e. Address for delivery of keys.

L. Coordination Conferences:
   1. Installation Coordination Conference: Prior to hardware installation, schedule and hold meeting to review questions or concerns related to proper installation and adjustment of door hardware.
      a. Attendees: Door Hardware Supplier, Door Hardware Installer, Architect, Contractor and Owners Representative.
      b. After meeting, provide letter of compliance to Architect, indicating when meeting was held and who was in attendance.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up for hardware delivered to Project site.

B. Tag each item or package separately with identification coordinated with final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package.

   1. Deliver each article of hardware in manufacturer's original packaging.

C. Project Conditions:

   1. Maintain manufacturer-recommended environmental conditions throughout storage and installation periods.

   2. Provide secure lock-up for door hardware delivered to Project, but not yet installed. Control handling and installation of hardware items so that completion of Work will not be delayed by hardware losses both before and after installation.

D. Protection and Damage:

   1. Promptly replace products damaged during shipping.

2. Handle hardware in manner to avoid damage, marring, or scratching. Correct, replace or repair products damaged during Work.

3. Protect products against malfunction due to paint, solvent, cleanser, or any chemical agent.

E. Deliver keys to manufacturer of key control system for subsequent delivery to Owner.
   1. Deliver keys and permanent cores to Owner by registered mail or overnight package service.

1.06 PROJECT CONDITIONS

A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.07 COORDINATION

A. Coordinate layout and installation of floor-recessed door hardware with floor construction. Cast anchoring inserts into concrete. Concrete, reinforcement, and formwork requirements are specified in Division 03.

B. Installation Templates: Distribute for doors, frames, and other work specified to be factory prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

C. Security: Coordinate installation of door hardware, keying, and access control with Owner's security consultant.

D. Electrical System Roughing-In: Coordinate layout and installation of electrified door hardware with connections to power supplies and building safety and security systems.

E. Existing Openings: Where hardware components are scheduled for application to existing construction or where modifications to existing door hardware are required, field verify existing conditions and coordinate installation of door hardware to suit opening conditions and to provide proper door operation.

F. Direct shipments not permitted, unless approved by Contractor.

1.08 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fails in materials or workmanship within specified warranty period.
   1. Warranty Period: Years from date of Substantial Completion, for durations indicated.
      a. Closers:
      b. Mechanical: 10 years.

c. Electrified: 2 years.
d. Exit Devices:
e. Mechanical: 3 years.
f. Electrified: 1 year.
g. Locksets:
h. Mechanical: 3 years.
i. Electrified: 1 year.
j. Continuous Hinges: Lifetime warranty.
k. Continuous Hinges: 10 years.
l. Key Blanks: Lifetime

2. Warranty does not cover damage or faulty operation due to improper installation, improper use or abuse.

1.09 MAINTENANCE

A. Maintenance Tools:
1. Furnish complete set of special tools required for maintenance and adjustment of hardware, including changing of cylinders.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. The Owner requires use of certain products for their unique characteristics and particular project suitability to insure continuity of existing and future performance and maintenance standards. After investigating available product offerings Awarding Authority has elected to prepare proprietary specifications. These products are specified with the notation: "No Substitute."
1. Where "No Substitute" is noted, submittals and substitution requests for other products will not be considered.

B. Approval of manufacturers other than those listed shall be in accordance with QUALITY ASSURANCE article, herein.

C. Approval of products from manufacturers indicated as "Acceptable Manufacturer" is contingent upon those products providing all functions and features and meeting all requirements of scheduled manufacturer's product.

Item	Scheduled Manufacturer	Acceptable Manufacturer
Hinges	Ives (IVE)	Bommer, Hager
Flush Bolts & Coordina-tors	Ives (IVE)	Burns, Hiawatha

Locksets & Deadlocks	Schlage (SCH)	
Exit Devices & Mullions	Von Duprin (VON)	
Cylinders & Keying	Schlage (SCH)	
Key Cabinets	Telkee (TEL)	HPC, Lund
Door Closers	LCN (LCN)	
Door Trim	Ives (IVE)	Burns, Hiawatha
Protection Plates	Ives (IVE)	Burns, Hiawatha
Overhead Stops	Glynn-Johnson (GLY)	ABH, Rixson
Stops & Holders	Ives (IVE)	Burns, Hiawatha
Thresholds & Weather-strip	National Guard Products (NGP)	Reese, Zero
Silencers	Ives (IVE)	Burns, Hiawatha
Magnetic Holders	LCN (LCN)	ABH, DynaLock
Door Position Switches	By Other (B/O)	

D. Hand of Door: Drawings show direction of slide, swing, or hand of each door leaf. Furnish each item of hardware for proper installation and operation of door movement as shown.

E. Where specified hardware is not adaptable to finished shape or size of members requiring hardware, furnish suitable types having same operation and quality as type specified, subject to Architect's approval.

2.02 MATERIALS

A. Fasteners
   1. Provide hardware manufactured to conform to published templates, generally prepared for machine screw installation.
   2. Furnish screws for installation with each hardware item. Finish exposed (exposed under any condition) screws to match hardware finish, or, if exposed in surfaces of other work, to match finish of this other work including prepared for paint surfaces to receive painted finish.
   3. Provide concealed fasteners for hardware units exposed when door is closed except when no standard units of type specified are available with concealed fasteners. Do not use thru-bolts for installation where bolt head or nut on opposite face is exposed in other work unless thru-bolts are required to fasten hardware securely. Review door specification and advise Architect if thru-bolts are required.
   4. Install hardware with fasteners provided by hardware manufacturer.

B. Provide screws, bolts, expansion shields, drop plates and other devices necessary for hardware installation.
   1. Where fasteners are exposed to view: Finish to match adjacent door hardware material.

2.03 HINGES, TEMPLATE

A. Provide template-produced hinges for hinges installed on flush wood doors, hollow-metal doors and hollow-metal frames.

B. Requirements:
   1. Minimum Size, Gauge and Weight of Hinge:
      a. 1-3/4 inch (44 mm) thick doors, up to and including 36 inches (914 mm) wide:
         1) Exterior: Standard weight 0.134 gauge, bronze or stainless steel, 4-1/2 inches (114 mm) high
         2) Interior: Standard weight 0.134 gauge, steel, 4-1/2 inches (114 mm) high
      b. 1-3/4 inch (44 mm) thick doors over 36 inches (914 mm) wide:
         1) Exterior: Heavy weight 0.190 gauge, bronze/stainless steel, 5 inches (127 mm) high
         2) Interior: Heavy weight 0.190 gauge, steel, 5 inches (127 mm) high
      c. 2 inches or thicker doors:
         1) Exterior: Heavy weight 0.190 gauge, bronze or stainless steel, 5 inches (127 mm) high
         2) Interior: Heavy weight (0190 gauge, steel, 5 inches (127 mm) high
      d. High frequency doors provide heavy weight hinges or where indicated in Hardware Set.
   2. Minimum number of Hinges:
      a. Doors 60 inches (1524mn) or less in height: Two (2) each.
      b. Doors over 60 inches (1524mm) and 90 inches (2286mm) or less in height: Three (3) each.
      c. Door over 90 inches (2286mm): One (1) for each additional hinge 30 inches (762mm) of height or fraction thereof.
      d. Dutch Door: Four (4) each.
   3. Where new hinges are specified for existing doors or existing frames, provide new hinges of identical size to hinge preparation present in existing door or existing frame.
   4. Hinge Pins: Except as otherwise indicated, provide hinge pins as follows:
      a. Steel Hinges: Steel pins
      b. Non-Ferrous Hinges: Stainless steel pins
      c. Out-Swinging Exterior Doors: Non-removable pins
      d. Out-Swinging Interior Lockable Doors: Non-removable pins
      e. Interior Non-lockable Doors: Non-rising pins
   5. Electrified Hinges:
      a. Through-Wire Hinge; provide with tamper-resistant fully concealed wires in the quantity and gauge to accommodate the electrical function of specified hardware.

1) Electrical requirements; 50 volts AC/DC at 3.5 amps continuous with 16 amps pulse.

b. Monitor Hinge; provide full concealed tamper-resistant monitor switch.
   1) Electrical requirements; 30 VDC at .5 amps.

c. Locate electrical hinge at the second hinge from the bottom or nearest to electrified locking component.

d. Provide junction box/mortar guard for each electrified hinge specified, unless specified in the hollow metal frame specification.

C. Provide five-knuckle, ball bearing hinges.
   1. Manufacturers and Products:
      a. Scheduled Manufacturer and Product:
         1) Ives 5BB series.
      b. Acceptable Manufacturers and Products:
         1) Bommer BB5000 series
         2) Hager BB series.
         3) McKinney TA/T4A series.
         4) Stanley FBB Series.

2.04 FLUSH BOLTS

A. Requirements:
   1. Provide automatic, constant latching, and manual flush bolts with forged bronze or stainless steel face plates, extruded brass levers, and with wrought brass guides and strikes. Provide 12 inch (305 mm) steel or brass rods at doors up to 90 inches (2286 mm) in height. For doors over 90 inches (2286 mm) in height increase top rods by 6 inches (152 mm) for each additional 6 inches (152 mm) of door height. Provide dust- proof strikes at each bottom flush bolt.

B. Manufacturers:
   1. Scheduled Manufacturer:
      a. Ives
   2. Acceptable Manufacturers:
      a. Burns
      b. Hiawatha

2.05 COORDINATORS

A. Requirements:
   1. Where pairs of doors are equipped with automatic flush bolts, an astragal, or other hardware that requires synchronized closing of the doors, provide bar-type coordinating device, surface applied to underside of stop at frame head.
   2. Provide filler bar of correct length for unit to span entire width of opening, and appropriate brackets for parallel arm door closers and surface vertical rod exit device strikes.

3. Factory-prep coordinators for vertical rod devices if required.

B. Manufacturers:
   1. Scheduled Manufacturer:
      a. Ives
   2. Acceptable Manufacturers:
      a. Burns
      b. Hiawatha

2.06 MORTISE LOCKS

A. Requirements:
   1. Provide mortise locks certified as ANSI A156.13, Grade 1 Operational, Grade 1 Security, and manufactured from heavy gauge steel, containing components of steel with a zinc dichromate plating for corrosion resistance. Provide lock case that is multi-function and field reversible for handing without opening case. Cylinders: Refer to "KEYING" article, herein.
   2. Provide locks with standard 2-3/4 inches (70 mm) backset with full 3/4 inch (19 mm) throw stainless steel mechanical anti-friction latchbolt. Provide deadbolt with full 1 inch (25 mm) throw, constructed of stainless steel.
   3. Provide standard ASA strikes unless extended lip strikes are necessary to protect trim.
   4. Provide electrical options as scheduled. Provide electrified locksets with micro switch (RX) option that monitors retractor crank, and is actuated when rotation of inside or outside lever rotates retractor hub. Provide normally closed contacts or normally open contacts as required by security system.
   5. Lever Trim: Solid brass, bronze, or stainless steel, cast or forged in design specified, with wrought roses and external lever spring cages. Provide thru-bolted levers with 2-piece spindles.
      a. Lever Design: Schlage 06A.
      b. Tactile Warning (Knurling): Where required by authority having jurisdiction. Provide on levers on exterior (secure side) of doors serving rooms considered to be hazardous.

B. Manufacturers and Products:
   1. Scheduled Manufacturer and Product:
      a. Schlage L9000 series No Substitution

2.07 EXIT DEVICES

A. Requirements:
   1. Provide exit devices tested to ANSI/BHMA A156.3 Grade 1, and UL listed for Panic Exit or Fire Exit Hardware. Cylinders: Refer to "KEYING" article, herein.
   2. Provide touchpad type exit devices, fabricated of brass, bronze, stainless steel, or aluminum, plated to standard architectural finishes to match balance of door hardware.

3. Quiet Operation: Incorporate fluid damper or other device that eliminates noise of exit device operation.
4. Touchpad: Extend minimum of one half of door width, but not the full length of exit device rail. Provide end-cap with two-point attachment to door. Match exit device finish, stainless steel for US26, US26D, US28, US32, and US32D finishes; and for all other finishes, provide compatible finish to exit device. Provide compression springs in devices, latches, and outside trims or controls; tension springs prohibited.
5. Provide exit devices with deadlatching feature for security and for future addition of alarm kits and/or other electrical requirements.
6. Provide exit devices with manufacturer's approved strikes.
7. Provide exit devices cut to door width and height. Locate exit devices at height recommended by exit device manufacturer, allowable by governing building codes, and approved by Architect.
8. Mount mechanism case flush on face of doors, or provide spacers to fill gaps behind devices. Where glass trim or molding projects off face of door, provide glass bead kits.
9. Dogging:
    a. Provide cylinder dogging (CD) at non-fire-rated exit devices, unless specified less dogging (LD).
10. Where lever handles are specified as outside trim for exit devices, provide heavy-duty lever trims with forged or cast escutcheon plates. Provide vandal-resistant levers that will travel to 90-degree down position when more than 35 pounds of torque are applied, and which can easily be re-set.
    a. Lever Style: Match lever style of locksets.
    b. Tactile Warning (Knurling): Where required by authority having jurisdiction. Provide on levers on exterior (secure side) of doors serving rooms considered to be hazardous.
11. Provide UL labeled fire exit hardware for fire rated openings.
12. Provide factory drilled weep holes for exit devices used in full exterior application, highly corrosive areas, and where noted in hardware sets.
13. Provide electrical options as scheduled.

B. Manufacturer and Product:
    1. Von Duprin 98/35 series No Substitution

2.08 CYLINDERS

A. Requirements: Provide cylinders/cores complying with the following requirements.
    1. Cylinders/cores compliant with ANSI/BHMA A156.5; latest revision, Section 12, Grade 1; permanent cylinders; cylinder face finished to match lockset, manufacturer's series as indicated.

B. Provide full-sized cylinders with permanent full size interchangeable core (FSIC) in the below-listed configuration(s), distributed throughout the Project as indicated.
    1. Conventional: Everest T cylinder with a patented, restricted keyway.

C. Features: Cylinders/cores shall incorporate the following features.
   1. Patent Protection: Cylinders/cores requiring use of restricted, patented keys, patent-protected until the year, 2029.
   2. Nickel silver bottom pins.
   3. Identification Stamping:
      a. Stamp permanent cores with Concealed Key Control (CKC) with either keyset or unique symbol furnished by the owner.
      b. Identification stamping provisions must be approved by the Architect and Owner.
      c. Failure to comply with stamping requirements shall be cause for replacement of cylinders/cores involved at no additional cost to Owner.

D. Shipping: Forward cylinders/cores to Owner, separately from keys, by means as directed by Owner. See paragraph 1.6 DELIVERY, STORAGE AND HANDLING

E. Replaceable Construction Cores.
   1. Provide temporary construction cores replaceable by permanent cores, furnished in accordance with the following requirements.
   2. Owner or Owner's Representative will replace temporary construction cores with permanent cores.

F. Manufacturer and Product:
   1. Scheduled Manufacturer and Product: Schlage Everest 29, No Substitute

2.09 KEYING

A. Keying System: Factory registered, complying with guidelines in ANSI/BHMA A156.28, incorporating decisions made at keying conference.

B. Keying Requirements – General
   1. Provide keying system capable of multiplex master keying with a 4-level hierarchy.
   2. Permanent cylinders/cores keyed by the manufacturer according to the following key system.
      a. Grand Master Key System: Cylinders/cores operated by change (day) keys, master key and grand master key.
   3. Forward bitting list and keys separately from cylinders, by means as directed by Owner. Failure to comply with forwarding requirements shall be cause for replacement of cylinders/cores involved at no additional cost to Owner.

C. Key Features: Provide keys with the following features.
   1. Patent Protection: Keys and blanks protected by one or more utility patent(s) until the year, 2029.

D. Keys
   1. Material: Nickel silver; minimum thickness of .107-inch (2.3mm)
   2. Identification:

a. Coordinate with cylinder/core and key identification requirements above.
b. Stamp permanent keys with Visional Key Control (VKC) either with keyset symbol or unique symbol furnished by the owner.
c. Stamp keys with Owner's unique key system facility code as established by the manufacturer
d. Stamp keys with "DO NOT DUPLICATE" along with the "PATENTED" or patent number to enforce the patent protection.
e. Identification stamping provisions must be approved by the Architect and Owner.
f. Failure to comply with stamping requirements shall be cause for replacement of keys involved at no additional cost to Owner.

3. Cut Keys: Furnish in the following quantities.
   a. Change (Day) Keys: Three (3) per cylinder/core.
   b. Keyed Alike set: Six (6) each or as director by owner.
   c. Permanent Control Keys: Three (3) each.
   d. Master Keys (MK): Six (6) each per master.
   e. Grand Master Keys (GMK): Six (6) each per grand master.
   f. Unused balance of key blanks shall be furnished to Owner with the cut keys.
4. Special Keys: Furnish in the following quantities.
   a. Construction Keys: Ten (10) each.
   b. Construction Control Keys: Three (3) each.

2.10 KEY STORAGE SYSTEM

A. Key Control System Requirements:
1. Provide key control system, including envelopes, labels, tags with self-locking key clips, receipt forms, 3-way visible card index, temporary markers, permanent markers, and standard metal cabinet, all as recommended by system manufacturer, with capacity for 150% of number of locks required for Project.
   a. Provide complete cross index system set up by hardware supplier, and place keys on markers and hooks in cabinet as determined by final key schedule.
   b. Provide hinged-panel type cabinet for wall mounting.

B. Manufacturers:
1. Scheduled Manufacturer:
   a. Telkee
2. Acceptable Manufacturers:
   a. HPC
   b. Lund

2.11 SURFACE DOOR CLOSERS

A. Closer Requirements:
1. Provide door closers certified to ANSI/BHMA A156.4 Grade 1 requirements by BHMA certified independent testing laboratory. Certify surface mounted mechanical closers to

exceed ten million (10,000,000) full load cycles. ISO 9000 certify closers. Stamp units with date of manufacture code.

2. Provide door closers with fully hydraulic, full rack and pinion action with high strength cast iron cylinder, and full complement bearings at shaft.

3. Cylinder Body: 1-1/2 inch (38 mm) diameter with 11/16 inch (17 mm) diameter double heat-treated pinion journal.

4. Hydraulic Fluid: Fireproof, passing requirements of UL10C, and requiring no seasonal closer adjustment for temperatures ranging from 120 degrees F to -30 degrees F.

5. Spring Power: Continuously adjustable over full range of closer sizes, and providing reduced opening force as required by accessibility codes and standards.

6. Hydraulic Regulation: By tamper-proof, non-critical valves, with separate adjustment for latch speed, general speed, and backcheck.

7. Provide closers with solid forged steel main arms and factory assembled heavy-duty forged forearms for parallel arm closers. When closers are parallel arm mounted, provide closers which mount within 6-inch (152 mm) top rail without use of mounting plate so that closer is not visible through vision panel from pull side.

8. Pressure Relief Valve (PRV) Technology: Not permitted.

9. Finish for Closer Cylinders, Arms, Adapter Plates, and Metal Covers: Powder coating finish which has been certified to exceed 100 hours salt spray testing as described in ANSI Standard A156.4 and ASTM B117, or has special rust inhibitor (SRI).

10. Provide special templates, drop plates, mounting brackets, or adapters for arms as required for details, overhead stops, and other door hardware items interfering with closer mounting.

B. Manufacturer and Product:
   1. LCN 4040XP series. No Substitute

2.12 DOOR TRIM

A. Push Plates:
   1. Provide push plates 4 inches (102 mm) wide by 16 inches (406 mm) high by 0.050 inch (1 mm) thick and beveled 4 edges.
   2. Where width of door stile prevents use of 4 inches (102 mm) wide plate, adjust width to fit.
   3. Manufacturers:
      a. Scheduled Manufacturer:
         1) Ives
      b. Acceptable Manufacturers:
         1) Burns
         2) Hiawatha

B. Pull Plates:
1. Provide pull plates 4 inches (102 mm) wide by 16 inches (406 mm) high by 0.050 inch (1 mm) thick, beveled 4 edges, and prepped for pull.
2. Where width of door stile prevents use of 4 inches (102 mm) wide plate, adjust width to fit.
3. Manufacturers:
a. Scheduled Manufacturer:
1) Ives
b. Acceptable Manufacturers:
1) Burns
2) Hiawatha

2.13 PROTECTION PLATES

A. Requirements:

1. Provide kick plates, mop plates, and armor plates minimum of 0.050 inch (1 mm) thick as scheduled. Furnish with sheet metal or wood screws, finished to match plates.
2. Sizes of plates:
a. Kick Plates: 10 inches (254 mm) high by 2 inches (51 mm) less width of door on single doors, 1 inch (25 mm) less width of door on pairs
b. Mop Plates: 10 inches (102 mm) high by 2 inches (51 mm) less width of door on single doors, 1 inch (25 mm) less width of door on pairs
c. Armor Plates: 36 inches (914 mm) high by 2 inches (51 mm) less width of door on single doors, 1 inch (25 mm) less width of door on pairs

B. Manufacturers:
1. Scheduled Manufacturer:
a. Ives
2. Acceptable Manufacturers:
a. Burns
b. Hiawatha

2.14 OVERHEAD STOPS AND OVERHEAD STOP/HOLDERS

A. Requirements:
1. Provide heavy duty concealed mounted overhead stop or holder as specified for exterior and interior vestibule single acting doors.
2. Provide heavy duty concealed mounted overhead stop or holder as specified for double acting doors.
3. Provide heavy or medium duty and concealed or surface mounted overhead stop or holder for interior doors as specified. Provide medium duty surface mounted overhead stop for interior doors and at any door that swings more than 140 degrees before striking wall, open against equipment, casework, sidelights, and where conditions do not allow wall stop or floor stop presents tripping hazard.

4. Where overhead holders are specified provide friction type at doors without closer and positive type at doors with closer.

B. Manufacturers:
   1. Scheduled Manufacturers:
      a. Glynn-Johnson
   2. Acceptable Manufacturers:
      a. ABH
      b. Rixson

2.15 DOOR STOPS AND HOLDERS

A. Provide door stops at each door leaf:
   1. Provide wall stops wherever possible. Provide convex type where mortise type locks are used and concave type where cylindrical type locks are used.
   2. Where a wall stop cannot be used, provide universal floor stops for low or high rise options.
   3. Where wall or floor stop cannot be used, provide medium duty surface mounted overhead stop.

B. Manufacturers:
   1. Scheduled Manufacturer:
      a. Ives.
   2. Acceptable Manufacturers:
      a. Burns
      b. Hiawatha

2.16 THRESHOLDS, SEALS, DOOR SWEEPS, AUTOMATIC DOOR BOTTOMS, AND GASKETING

A. Requirements:
   1. Provide thresholds, weatherstripping (including door sweeps, seals, and astragals) and gasketing systems (including smoke, sound, and light) as specified and per architectural details. Match finish of other items.
   2. Size of thresholds::
      a. Saddle Thresholds: 1/2 inch (13 mm) high by jamb width by door width
      b. Bumper Seal Thresholds: 1/2 inch (13 mm) high by 5 inches (127 mm) wide by door width
   3. Provide door sweeps, seals, astragals, and auto door bottoms only of type where resilient or flexible seal strip is easily replaceable and readily available.

B. Manufacturers:
   1. Scheduled Manufacturer:
      a. National Guard Products
   2. Acceptable Manufacturers:
      a. Reese

b. Zero

2.17 SILENCERS

A. Requirements:
1. Provide "push-in" type silencers for hollow metal or wood frames.
2. Provide one silencer per 30 inches (762 mm) of height on each single frame, and two for each pair frame.
3. Omit where gasketing is specified.

B. Manufacturers:
1. Scheduled Manufacturer:
   a. Ives
2. Acceptable Manufacturers:
   a. Burns
   b. Hiawatha

2.18 MAGNETIC HOLDERS

A. Requirements:
1. Provide wall or floor mounted electromagnetic door release as specified with minimum of 25 pounds of holding force. Coordination projection of holder and armature with other hardware and wall conditions to ensure that door sits parallel to wall when fully open. Wire magnetic holders on fire-rated doors into the fire control panel for fail-safe operation.

B. Manufacturers:
1. Scheduled Manufacturer:
   a. LCN 7800 series
2. Acceptable Manufacturers:
   a. ABH 2000 series
   b. DynaLock 2800 series

2.19 FINISHES

A. Finish: BHMA 626/652 (US26D); except:
1. Hinges at Exterior Doors: BHMA 630 (US32D)
2. Push Plates, Pulls, and Push Bars: BHMA 630 (US32D)
3. Protection Plates: BHMA 630 (US32D)
4. Overhead Stops and Holders: BHMA 630 (US32D)
5. Door Closers: Powder Coat to Match
6. Wall Stops: BHMA 630 (US32D)
7. Weatherstripping: Clear Anodized Aluminum
8. Thresholds: Mill Finish Aluminum

PART 3 - EXECUTION

3.1 EXAMINATION

A. Prior to installation of hardware, examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance.

B. Existing Door and Frame Compatibility: Field verify existing doors and frames receiving new hardware and existing conditions receiving new openings. Verify that new hardware is compatible with existing door and frame preparation and existing conditions.

C. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Where on-site modification of doors and frames is required:
   1. Remove existing hardware being replaced, tag, and store according to contract documents.
   2. Field modify and prepare existing door and frame for new hardware being installed.
   3. When modifications are exposed to view, use concealed fasteners, when possible.
   4. Prepare hardware locations in accordance with:
      a. Steel Doors and Frames: For surface applied door hardware, drill and tap doors and frames according to ANSI/SDI A250.6.
      b. Wood Doors: DHI WDHS.5 "Recommended Hardware Reinforcement Locations for Mineral Core Wood Flush Doors."
      c. Doors in rated assemblies: NFPA 80 for restrictions on on-site door hardware preparation.

3.3 INSTALLATION

A. Mounting Heights: Mount door hardware units at heights to comply with the following, unless otherwise indicated or required to comply with governing regulations.
   1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
   2. Custom Steel Doors and Frames: HMMA 831.
   3. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."

B. Install each hardware item in compliance with manufacturer’s instructions and recommendations, using only fasteners provided by manufacturer.

C. Do not install surface mounted items until finishes have been completed on substrate. Protect all installed hardware during painting.

D. Set units level, plumb and true to line and location. Adjust and reinforce attachment substrate as necessary for proper installation and operation.

E. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.

F. Install operating parts so they move freely and smoothly without binding, sticking, or excessive clearance.

G. Hinges: Install types and in quantities indicated in door hardware schedule but not fewer than quantity recommended by manufacturer for application indicated or one hinge for every 30 inches (750 mm) of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.

H. Intermediate Offset Pivots: Where offset pivots are indicated, provide intermediate offset pivots in quantities indicated in door hardware schedule but not fewer than one intermediate offset pivot per door and one additional intermediate offset pivot for every 30 inches (750 mm) of door height greater than 90 inches (2286 mm).

I. Lock Cylinders: Install construction cores to secure building and areas during construction period.

1. Replace construction cores with permanent cores as indicated in keying section.

J. Key Control System: Tag keys and place them on markers and hooks in key control system cabinet, as determined by final keying schedule.

K. Door Closers: Mount closers on room side of corridor doors, inside of exterior doors, and stair side of stairway doors from corridors. Closers shall not be visible in corridors, lobbies and other public spaces unless approved by Architect.

L. Thresholds: Set thresholds in full bed of sealant complying with requirements specified in Division 07 Section "Joint Sealants."

M. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they may impede traffic or present tripping hazard.

N. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.

O. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.

P. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

3.4 FIELD QUALITY CONTROL

A. Architectural Hardware Consultant: Engage qualified independent Architectural Hardware Consultant to perform inspections and to prepare inspection reports.

1. Architectural Hardware Consultant will inspect door hardware and state in each report whether installed work complies with or deviates from requirements, including whether door hardware is properly installed and adjusted.
2. Architectural Hardware Consultant will have each Door Hardware Manufacturer's representative inspect their Hardware for compliance of the recommended installation and adjustment standards. This is to include but not limited to Exit Devices, Door Closers and Locksets. Each manufacture is to furnish a letter of certification.

3.5 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

1. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.

B. Occupancy Adjustment: Approximately six (6) months after date of Substantial Completion, Installer's Architectural Hardware Consultant shall examine and readjust each item of door hardware, including adjusting operating forces, as necessary to ensure function of doors, door hardware, and electrified door hardware.

3.6 CLEANING AND PROTECTION

A. Clean adjacent surfaces soiled by door hardware installation.

B. Clean operating items as necessary to restore proper function and finish.

C. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of Substantial Completion.

3.7 DEMONSTRATION

A. Provide training for Owner's maintenance personnel to adjust, operate, and maintain door hardware and door hardware finishes. Refer to Division 01 Section "Demonstration and Training."

3.8 DOOR HARDWARE SCHEDULE

A. Locksets, exit devices, and other hardware items are referenced in the following hardware sets for series, type and function. Refer to the above-specifications for special features, options, cylinders/keying, and other requirements.

B. Hardware Sets: Refer to the drawings.

END OF SECTION

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SECTION 08800

GLAZING

PART 1 - GENERAL

1.01 GENERAL PROVISIONS

A. 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.

1.02 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Glass and glazing for the following products and applications:
   a. Steel doors, frames and sidelights specified in Section 08111 - HOLLOW METAL DOORS AND FRAMES.
   b. Steel windows specified in Section 08510 – STEEL WINDOWS.

B. Related Work: The following items are not included in this Section and are specified under the designated Sections:

1. Section 08510 - STEEL WINDOWS for factory glazing for metal windows.

2. Section 08111 - HOLLOW METAL DOORS AND FRAMES for factory glazing for doors.

1.03 SUBMITTALS

A. Product Data: For each glass product and glazing material indicated.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed glazing similar in material, design, and extent to that indicated for this Project; whose work has resulted in glass installations with a record of successful in-service performance..

B. Safety Glazing Products: Comply with testing requirements in 16 CFR 1201.

1. Subject to compliance with requirements, obtain safety glazing products permanently marked with certification label of the Safety Glazing Certification Council or another certification agency] acceptable to authorities having jurisdiction.

2. Where glazing units, including Kind FT glass and laminated glass, are specified in Part 2 articles for glazing lites more than 9 sq. ft. in exposed surface area of one side, provide glazing products that comply with Category II materials, for lites 9 sq. ft. or less in exposed surface area of one side, provide glazing products that comply with Category I or II materials, except for hazardous locations where Category II materials are required by 16 CFR 1201 and regulations of authorities having jurisdiction.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials according to manufacturer's written instructions and as needed to prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

1.06 PROJECT CONDITIONS

A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.

PART 2 - PRODUCTS

2.01 GLASS PRODUCTS

1. The Window configurations are composed of an unequal sash layout:
    1) A smaller, fixed upper sash, over a larger, out-opening, lower awning sash.
    2) The muntin layout of the simulated divided lites is 8 over 12 (all lites to be same proportions).
        a) The muntins shall be provided at both exterior and interior sides of the glass.
2. The glazing at both top and bottom sashes shall be Insulated Glazed Unites (IGU) composed of:
    1) Outer layer: Single layer ¼” clear glass;
    2) Argon filled space;
    3) Inner layer: Single layer clear laminated glass, composed of:
        a) 3/16” clear glass
        b) 1/16” clear polybutyl interlayer
        c) 3/16” clear glass.

B. Tempered Float Glass: ASTM C 1048; Type I (transparent flat glass); Quality-Q3; Kind FT; 1/4 inch thick unless indicated otherwise.

C. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based elastomeric tape with a solids content of 100 percent; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass

manufacturers for application indicated; packaged on rolls with a release paper backing; and complying with ASTM C 1281 and AAMA 800 for project conditions.

2.02 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

C. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.

D. Spacers: Elastomeric blocks or continuous extrusions with a Shore, Type A durometer hardness required by glass manufacturer to maintain glass lites in place for installation indicated.

E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).

2.03 FABRICATION OF GLAZING UNITS

A. Fabricate glazing units in sizes required to glaze openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.

B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites in a manner that produces square edges with slight kerfs at junctions with outdoor and indoor faces.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine framing glazing, with Installer present, for compliance with the following:

1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
2. Presence and functioning of weep system.
3. Minimum required face or edge clearances.
4. Effective sealing between joints of glass-framing members.

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

3.02 PREPARATION

A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

3.03 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

B. Glazing channel dimensions, as indicated on Drawings, provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances. Adjust as required by Project conditions during installation.

C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.

D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction sealant-substrate testing.

E. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

G. Provide spacers for glass lites where length plus width is larger than 50 inches as follows:

1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
2. Provide 1/8-inch minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

H. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.

I. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

3.04 TAPE GLAZING

A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.

B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.

C. Cover vertical framing joints by applying tapes to heads and sills first and then to jambs. Cover horizontal framing joints by applying tapes to jambs and then to heads and sills.

D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.

E. Do not remove release paper from tape until just before each glazing unit is installed.

F. Center glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

3.05 CLEANING AND PROTECTION

A. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels, and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations, including weld splatter. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended by glass manufacturer.

C. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains; remove as recommended in writing by glass manufacturer.

D. Remove and replace glass that is broken, chipped, cracked, or abraded or that is damaged from natural causes, accidents, and vandalism, during construction period.

END OF SECTION

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SECTION 08900

LOUVERS AND VENTS

PART 1 - GENERAL

1.01 GENERAL PROVISIONS

A. 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.

1.02 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Exterior stormproof stainless steel louvers.
2. Exterior stormproof extruded aluminum louvers (to match window frame color and profile).
3. Bird and insect screen at all exterior louvers.

B. Related Work: The following items are not included in this Section and are specified under the designated Sections:

1. Section 07920 - JOINT SEALANTS for sealants installed in perimeter joints between louver frames and adjoining construction.
2. Division 15 - HEATING, VENTILATING AND AIR CONDITIONING for louvers that are a part of mechanical equipment.

1.03 DEFINITIONS

A. Louver Terminology: Definitions of terms for metal louvers contained in AMCA 501 apply to this Section unless otherwise defined in this Section or in referenced standards.

B. Drainable-Blade Louver: Louver with blades having gutters that collect water and drain it to channels in jambs and mullions, which carry it to bottom of unit and away from opening.

1.04 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide louvers capable of withstanding the effects of gravity loads and wind loads and stresses within limits and under conditions indicated without permanent deformation of louver components, noise or metal fatigue caused by louver blade rattle or flutter, or permanent damage to fasteners and anchors. Wind pressures shall be considered to act on vertical projection of louvers. Loads as required by Code.

B. Seismic Performance: Provide louvers capable of withstanding the effects of earthquake motions as required by code.

C. Thermal Movements: Provide louvers that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F ambient; 180 deg F material surfaces.

1.05 SUBMITTALS

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

B. Shop Drawings: For louvers and accessories. Include plans, elevations, sections, details, and attachments to other Work. Show blade profiles, angles, and spacing.

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

C. Samples for Verification: For each type of metal finish required.

D. Qualification Data: For professional engineer.

E. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency or by manufacturer and witnessed by a qualified testing agency, for each type of louver.

1.06 QUALITY ASSURANCE

A. Source Limitations: Obtain louvers and vents through one source from a single manufacturer where indicated to be of same type, design, or factory-applied color finish.

B. Welding: Qualify procedures and personnel according to the following:

1. AWS D1.2, "Structural Welding Code--Aluminum."

C. SMACNA Standard: Comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" for fabrication, construction details, and installation procedures.

1.07 PROJECT CONDITIONS

A. Field Measurements: Verify louver openings by field measurements before fabrication and indicate measurements on Shop Drawings.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish opening dimensions and proceed with fabricating louvers without field measurements. Coordinate construction to ensure that actual opening dimensions correspond to established dimensions.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

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

1. Louvers and Vents:
   a. Airolite Company, LLC.
   b. Construction Specialties, Inc.
   c. Greenheck.
   d. Industrial Louvers, Inc.
   e. McDermott Metal Works Corporation

2.02 MATERIALS

A. Aluminum Extrusions: ASTM B 221, alloy 6063-T5 or T-52.

B. Aluminum Sheet: ASTM B 209, alloy 3003 or 5005 with temper as required for forming, or as otherwise recommended by metal producer for required finish.

C. Stainless Steel: ASTM A666, Type 316 stainless steel.

D. Fasteners: Of same basic metal and alloy as fastened metal or 300 Series stainless steel, unless otherwise indicated. Do not use metals that are incompatible with joined materials.

E. Postinstalled Fasteners for Concrete and Masonry: Torque-controlled expansion anchors, made from stainless-steel components, with capability to sustain, without failure, a load equal to 4 times the loads imposed, for concrete, or 6 times the load imposed, for masonry, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.

F. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.03 FABRICATION, GENERAL

A. Assemble louvers in factory to minimize field splicing and assembly. Disassemble units as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

B. Maintain equal louver blade spacing, including separation between blades and frames at head and sill, to produce uniform appearance.

C. Fabricate frames, including integral sills, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.

D. Include supports, anchorages, and accessories required for complete assembly.

E. Provide vertical mullions of type and at spacings indicated, but not more than recommended by manufacturer, or 72 inches o.c., whichever is less.

1. Fully Recessed Mullions: Provide mullions fully recessed behind louver blades. Where length of louver exceeds fabrication and handling limitations, fabricate with close-fitting blade splices designed to permit expansion and contraction.

F. Join frame members to each other and to fixed louver blades with fillet welds concealed from view, unless otherwise indicated or size of louver assembly makes bolted connections between frame members necessary.

2.04 FIXED LOUVERS

A. Horizontal Storm-Resistant and Drainable Louvers:

1. Louver Depth: As indicated.
2. Frame and Blade Nominal Thickness: As required to comply with structural performance requirements, but not less than 0.080 inch.
3. Performance Requirements:

a. Free Area: Comply with requirements indicated on the Drawings.
b. Wind-Driven Rain Performance: Not less than 99 percent effectiveness when subjected to a rain fall rate of 3 inches per hour and a wind speed of 29 mph at a core area intake velocity of 300 fpm.

4. AMCA Seal: Mark units with AMCA Certified Ratings Seal.

B. High-Performance Organic-Coating Finish: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid-chromate-fluoride-phosphate conversion coating; Organic Coating: as specified below). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

1. Fluoropolymer Three-Coat Coating System: Manufacturer's standard three-coat, thermocured system consisting of specially formulated inhibitive primer, fluoropolymer color coat, and clear fluoropolymer topcoat, with both color coat and clear topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with AAMA 2605.
a. Color and Gloss: As selected by Engineer from manufacturer's full range.

2.05 LOUVER SCREENS

A. General: Provide screen at each exterior louver.

1. Screen Location for Fixed Louvers: Interior face.
2. Screening Type: Bird and insect screening.

B. Secure screens to louver frames with stainless-steel machine screws, spaced a maximum of 6 inches from each corner and at 12 inches o.c.

C. Louver Screen Frames: Fabricate with mitered corners to louver sizes indicated.

2.06 BLANK-OFF PANELS

A. Insulated, Blank-off Panels: Laminated metal-faced panels consisting of insulating core surfaced on back and front with metal sheets.

1. Thickness: 1 inch.
2. Metal Facing Sheets: Aluminum sheet, not less than 0.032-inch nominal thickness.
3. Insulating Core: Rigid insulation board.
4. Seal perimeter joints between panel faces and louver frames with 1/8-by-l-inch PVC compression gaskets.
5. Panel Finish: Same finish applied to louvers.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates and openings, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Coordinate setting drawings, diagrams, templates, instructions, and directions for installation of anchorages that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to Project site.

3.03 INSTALLATION

A. Locate and place louvers and vents level, plumb, and at indicated alignment with adjacent work.

B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.

C. Form closely fitted joints with exposed connections accurately located and secured.

D. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.

E. Repair finishes damaged by cutting, welding, soldering, and grinding. Restore finishes so no evidence remains of corrective work. Return items that cannot be refinished in the field to the factory, make required alterations, and refinish entire unit or provide new units.

F. Protect galvanized and nonferrous-metal surfaces from corrosion or galvanic action by applying a heavy coating of bituminous paint on surfaces that will be in contact with concrete, masonry, or dissimilar metals.

G. Install concealed gaskets, flashings, joint fillers, and insulation as louver installation progresses, where weathertight louver joints are required. Comply with Section 07920 - JOINT SEALANTS for sealants applied during louver installation.

3.04 ADJUSTING AND CLEANING

A. Clean exposed surfaces of louvers and vents that are not protected by temporary covering, to remove fingerprints and soil during construction period. Do not let soil accumulate until final cleaning.

B. Before final inspection, clean exposed surfaces with water and a mild soap or detergent not harmful to finishes. Thoroughly rinse surfaces and dry.

C. Restore louvers and vents damaged during installation and construction so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Engineer, remove damaged units and replace with new units.

1. Touch up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.

END OF SECTION

DIVISION 09

SECTION 09211

GYPSUM BOARD ASSEMBLIES

PART 1 - GENERAL

1.01 GENERAL PROVISIONS

A. 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.

1.02 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Interior gypsum wallboard.
2. Tile backing panels.
3. Acoustic insulation in gypsum wallboard assemblies.
4. Non-load-bearing steel framing.
5. Installation of access panels.
6. Marking and identification for fire- and smoke-partitions.

B. Related Work: The following items are not included in this Section and are specified under the designated Sections:

1. Section 05400 - COLD-FORMED METAL FRAMING for load-bearing steel framing.
2. Section 06160 - SHEATHING for gypsum sheathing at exterior assemblies.
3. Section 08311 - ACCESS DOORS AND FRAMES for installation in gypsum board assemblies.

1.03 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide fire stop tracks capable of withstanding deflection within limits and under conditions indicated.

1. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure.

B. Marking and Identification for Fire- and Smoke-Partitions: Fire walls, fire barriers, fire partitions, smoke barriers, smoke partitions and other walls required to have protected openings or penetrations shall be effectively and permanently identified with signs or stenciling. Such identification shall:

1. Be located in accessible concealed floor, floor-ceiling or attic spaces; and
2. Be repeated at intervals not exceeding 30 feet measured horizontally along the wall or partition; and
3. Include lettering not less than 0.5 inch in height, incorporating the suggested wording: "FIRE AND/OR SMOKE BARRIER - PROTECT ALL OPENINGS," or other wording.
4. Exception: Walls in Group R-2 occupancies that do not have a removable decorative ceiling allowing access to the concealed space.

1.04 SUBMITTALS

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

B. Samples: Full-size Sample in 12-inch-long length for each trim accessory indicated.

C. Shop Drawings: If materials and systems other than those specified and those indicated on the Drawings are proposed for use, submit shop drawings signed and sealed by a structural engineer licensed in the jurisdiction of the project certifying proposed systems meet code requirements, project requirements and the following deflection criteria:

1. For gypsum board assemblies without applied rigid finishes L/240; for gypsum board assemblies with applied rigid finishes such as tile, stone, wood paneling L/360. Lateral load 5 psf except at shafts. Lateral load at shafts shall be required based on analysis of equipment and systems using shaft.

1.05 QUALITY ASSURANCE

A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

C. Drywall Recycling: All new paper-faced gypsum wallboard scrap (cuts from construction but not demolition waste) shall be recycled by Gypsum Recycling America LLC or approved equal.

1.06 STORAGE AND HANDLING

A. Store materials inside under cover and keep them dry and protected against damage from weather, condensation, direct sunlight, construction traffic, and other causes. Stack panels flat to prevent sagging.

1.07 PROJECT CONDITIONS

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

B. Do not install interior products until installation areas are enclosed and conditioned.

C. Do not install panels that are wet, those that are moisture damaged, and those that are mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.01 NON-LOAD-BEARING STEEL FRAMING, GENERAL

A. Framing Members, General: Comply with ASTM C 754 for conditions indicated.

1. Steel Sheet Components: Comply with ASTM C 645 requirements for metal, unless otherwise indicated.
2. Protective Coating: Manufacturer's standard corrosion-resistant zinc coating, unless otherwise indicated.

2.02 SUSPENSION SYSTEM COMPONENTS

A. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.0625-inch-diameter wire, or double strand of 0.0475-inch-diameter wire.

B. Hanger Attachments to Concrete:

1. Anchors: Fabricated from corrosion-resistant materials with holes or loops for attaching wire hangers and capable of sustaining, without failure, a load equal to 5 times that imposed by construction as determined by testing according to ASTM E 488 by an independent testing agency.

a. Type: Postinstalled, expansion anchor.

C. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.162-inch diameter.

D. Carrying Channels: Cold-rolled, commercial-steel sheet with a base-metal thickness of 0.0538 inch and minimum 1/2-inch-wide flanges with depth as required for span and loading and indicated on Drawings.

E. Furring Channels (Furring Members): 0.0538-inch bare-steel thickness, with minimum 1/2-inch- wide flanges, 3/4 inch deep.

F. Grid Suspension System for Ceilings: ASTM C 645, direct-hung system composed of main beams and cross-furring members that interlock.

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

a. Armstrong World Industries, Inc.; Drywall Grid Systems.
b. Chicago Metallic Corporation; Drywall Furring System.
c. USG Corporation; Drywall Suspension System.

2.03 STEEL FRAMING FOR FRAMED ASSEMBLIES

A. Steel Studs and Runners: ASTM C 645.

1. Minimum Base-Metal Thickness: 0.0312 inch.

B. Slip-Type Head Joints: Where indicated, provide one of the following:

1. Single Long-Leg Runner System: ASTM C 645 top runner with 2-inch- deep flanges in thickness not less than indicated for studs, installed with studs friction fit into top runner and with continuous bridging located within 12 inches of the top of studs to provide lateral bracing.
2. Double-Runner System: ASTM C 645 top runners, inside runner with 2-inch-deep flanges in thickness not less than indicated for studs and fastened to studs, and outer runner sized to friction fit inside runner.
3. Deflection Track: Steel sheet top runner manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.

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

1) Steel Network Inc. (The); VertiClip Series.
2) Superior Metal Trim; Superior Flex Track System (SFT).

C. Fire Stop Tracks: Top runner manufactured to allow partition heads to expand and contract with movement of the structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness compatible with studs and in width to accommodate depth of studs.

1. Grace Construction Products; FlameSafe FlowTrak System.
2. Fire Trak Corp.; Fire Trak attached to studs with Fire Trak Slip Clip.
3. Metal-Lite, Inc.; The System.

D. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.

1. Minimum Base-Metal Thickness: 0.0312 inch.

E. Cold-Rolled Channel Bridging: 0.0538-inch bare-steel thickness, with minimum 1/2-inch- wide flanges.

1. Depth: 1-1/2 inches.
2. Clip Angle: Not less than 1-1/2 by 1-1/2 inches, 0.068-inch-thick, galvanized steel.

F. Hat-Shaped, Rigid Furring Channels: ASTM C 645.

1. Minimum Base Metal Thickness: 0.0312 inch.
2. Depth: 1-1/2 inches.

G. Resilient Furring Channels: 1/2-inch-deep, steel sheet members designed to reduce sound transmission.

1. Configuration: Asymmetrical or hat shaped.

H. Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches wall attachment flange of 7/8 inch, minimum bare-metal thickness of 0.0179 inch, and depth required to fit insulation thickness indicated.

I. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

J. Isolation Strip at Exterior Walls: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch thick, in width to suit steel stud size.

2.04 INTERIOR GYPSUM BOARD

PART 2 –PRODUCTS

2.05 SUSTAINABLE INTERIOR GYPSUM BOARD

A. Gypsum Board ASTM C1396/C1396M: Gypsum Wallboard, Gypsum Ceiling Board
1. Basis of Design: “USG Sheetrock Brand EcoSmart Panels”.
2. ISO 14040 Environmental Management, Life Cycle Assessment, Principles and Framework:
a. Carbon emissions per Gypsum Association; Industry Standard EPD for North American standard 1/2 in. gypsum panels have a value of 233.3 kg CO_2-eq./1000 ft^2: **[123 kg CO_2-eq./1000 ft^2]**.

b. Water reduction per Gypsum Association; Industry Standard EPD for North American standard 1/2 in. gypsum panels have a value of 1.07 m^3/1000 ft^2: **[0.64 m^3/1000 ft^2]**.
c. Primary Energy from non-renewable resources per Gypsum Association; Industry Standard EPD for North American standard 1/2 in. gypsum panels have a value of 4051.4 MJ/1000 ft^2: **[3198 MJ/1000 ft^2]**.

3. ASTM E136 Noncombustibility: Meets or exceeds criteria.
4. ASTM E84 Surface-Burning Characteristics:
   a. Flame Spread: 10.
   b. Smoke Developed: 0.
   c. Classification: Class A.
5. ASTM C473 B:
   a. Core Hardness: Meets or Exceeds 11.
   b. Flexural Strength (lbf).
      1) Parallel: Not less than 36.
      2) Perpendicular: Not less than 107.
   c. Nail Pull Resistance (lbf): Not less than 77.
6. Thickness: 5/8".
7. Length: 8-16 ft.
8. Width: 4 ft.
9. Weight: 1.15 lb./sq. ft.
10. Long Edges: Tapered.

B. Fire-Resistant Type X: ASTM C 1396.

1. Thickness: 5/8 inch.
2. Long Edges: Tapered.

2.06 TILE BACKING PANELS

A. Cementitious Backer Units: ANSI A118.9 and ASTM C 1288 or 1325, with manufacturer's standard edges.

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

   a. Custom Building Products; Wonderboard.
   b. FinPan, Inc.; Util-A-Crete Concrete Backer Board.
   c. National Gypsum Company; Permabase Cement Board.
   d. USG Corporation; DUROCK Cement Board.

2. Thickness: 5/8 inch.
3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

2.07 TRIM ACCESSORIES

A. Interior Trim: ASTM C 1047.

1. Material: Galvanized or aluminum-coated steel sheet or rolled zinc.
2. Shapes:

    a. Cornerbead.
    b. Bullnose bead.
    c. LC-Bead: J-shaped; exposed long flange receives joint compound.
    d. Expansion (control) joint.
    e. Curved-Edge Cornerbead: With notched or flexible flanges.

B. Aluminum Trim: Extruded accessories of profiles and dimensions indicated.

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

    a. Fry Reglet Corp.
    b. Gordon, Inc.
    c. Pittcon Industries.

2. Aluminum: Alloy and temper with not less than the strength and durability properties of ASTM B 221, Alloy 6063-T5.
3. Finish: Corrosion-resistant primer compatible with joint compound and finish materials specified.

2.08 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C 475/C 475M.

B. Joint Tape:

1. Interior Gypsum Wallboard: Paper.
2. Tile Backing Panels: As recommended by panel manufacturer.

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

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

2.09 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.

B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.

1. Use adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.

1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch thick.

D. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.

1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.

E. Acoustical Sealant: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

1. Use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Acoustical Sealant for Exposed and Concealed Joints:

a. Pecora Corp.; AC-20 FTR Acoustical and Insulation Sealant.
b. USG Corporation.; SHEETROCK Acoustical Sealant.

3. Acoustical Sealant for Concealed Joints:

a. Ohio Sealants, Inc.; Pro-Series SC-170 Rubber Base Sound Sealant.
b. Pecora Corp.; BA-98.
c. Tremco, Inc.; Tremco Acoustical Sealant.

2.10 IDENTIFICATION LABELS FOR FIRE- AND SMOKE-PARTITIONS

A. Identification Labels: Vinyl adhesive signs, to comply with applicable local Code.

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

a. Fire Wall Signs, Inc.
b. Safety Supply Warehouse.

2. Text: "FIRE AND SMOKE BARRIER - PROTECT ALL OPENINGS"

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames and framing, for compliance with requirements and other conditions affecting performance.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.

1. Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.

B. Coordination with Sprayed Fire-Resistive Materials:

1. Before sprayed fire-resistive materials are applied, attach offset anchor plates or ceiling runners (tracks) to surfaces indicated to receive sprayed fire-resistive materials. Where offset anchor plates are required, provide continuous plates fastened to building structure not more than 24 inches o.c.
2. After sprayed fire-resistive materials are applied, remove them only to extent necessary for installation of non-load-bearing steel framing. Do not reduce thickness of fire-resistive materials below that required for fire-resistance ratings indicated. Protect adjacent fire-resistive materials from damage.

3.03 INSTALLATION, GENERAL

A. Installation Standard: ASTM C 754. Also comply with requirements in ASTM C 840 that apply to framing installation.

B. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.

C. Install bracing at terminations in assemblies.

D. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.04 INSTALLING SUSPENSION SYSTEMS

A. Install suspension system components in sizes and spacings indicated on Drawings, but not less than those required by referenced installation standards for assembly types and other assembly components indicated.

B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.

C. Suspend hangers from building structure as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.

    a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.

2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.

    a. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards.

3. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.
4. Flat Hangers: Secure to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices and fasteners that are secure and appropriate for structure and hanger, and in a manner that will not cause hangers to deteriorate or otherwise fail.
5. Do not attach hangers to steel roof deck.
6. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
7. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
8. Do not connect or suspend steel framing from ducts, pipes, or conduit.

D. Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports.

E. Seismic Bracing: Sway-brace suspension systems with hangers used for support.

F. Grid Suspension Systems: Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.

G. Installation Tolerances: Install suspension systems that are level to within [1/8 inch in 12 feet measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

3.05 INSTALLING FRAMED ASSEMBLIES

A. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.

B. Install studs so flanges within framing system point in same direction.

C. Install tracks (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts penetrating partitions above ceiling.

1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on doorframes; install runner track section (for cripple studs) at head and secure to jamb studs.

    a. Install two studs at each jamb, unless otherwise indicated.
    b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch clearance from jamb stud to allow for installation of control joint in finished assembly.
    c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.

3. Other Framed Openings: Frame openings other than door openings the same as required for door openings, unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
4. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.

    a. Firestop Track: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.

5. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.
6. Curved Partitions:

    a. Bend track to uniform curve and locate straight lengths so they are tangent to arcs.

b. Begin and end each arc with a stud, and space intermediate studs equally along arcs. On straight lengths of not less than 2 studs at ends of arcs, place studs 6 inches o.c.

D. Direct Furring: Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.

E. Z-Furring Members:

1. Erect insulation vertically and hold in place with Z-furring members spaced 24 inches o.c.
2. Except at exterior corners, securely attach narrow flanges of furring members to wall with concrete stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.
3. At exterior corners, attach wide flange of furring members to wall with short flange extending beyond corner; on adjacent wall surface, screw-attach short flange of furring channel to web of attached channel. At interior corners, space second member no more than 12 inches from corner and cut insulation to fit.

3.06 APPLYING AND FINISHING PANELS, GENERAL

A. Comply with ASTM C 840.

B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.

C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.

D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.

E. Form control and expansion joints with space between edges of adjoining gypsum panels.

F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.

1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
2. Fit gypsum panels around ducts, pipes, and conduits.

3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch- wide joints to install sealant.

G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch- wide spaces at these locations, and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

3.07 APPLYING INTERIOR GYPSUM BOARD

A. Single-Layer Application:

1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing, unless otherwise indicated.
2. On partitions/walls, apply gypsum panels to minimize end joints.
3. On Z-furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
4. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

B. Multilayer Application:

1. On ceilings, apply gypsum board indicated for base layers before applying base layers on walls/partitions; apply face layers in same sequence. Apply base layers at right angles to framing members and offset face-layer joints 1 framing member, 16 inches minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.
2. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
3. On Z-furring members, apply base layer vertically (parallel to framing) and face layer either vertically (parallel to framing) or horizontally (perpendicular to framing) with vertical joints offset at least one furring member. Locate edge joints of base layer over furring members.
4. Fastening Methods: Fasten base layers and face layers separately to supports with screws.

C. Laminating to Substrate: Where gypsum panels are indicated as directly adhered to a substrate (other than studs, joists, furring members, or base layer of gypsum board), comply with gypsum board manufacturer's written recommendations and temporarily brace or fasten gypsum panels until fastening adhesive has set.

D. Curved Surfaces:

1. Install panels horizontally (perpendicular to supports) and unbroken, to extent possible, across curved surface plus 12-inch-long straight sections at ends of curves and tangent to them.
2. For double-layer construction, fasten base layer to studs with screws 16 inches o.c. Center gypsum board face layer over joints in base layer, and fasten to studs with screws spaced 12 inches o.c.

3.08 INSTALLING TRIM ACCESSORIES

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

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

C. Interior Trim: Install in the following locations:

1. Cornerbead: Use at outside corners, unless otherwise indicated.
2. LC-Bead: Use at exposed panel edges.
3. Curved-Edge Cornerbead: Use at curved openings.

D. Aluminum Trim: Install in locations indicated on Drawings.

3.09 APPLYING TILE BACKING PANELS

A. Cementitious Backer Units: ANSI A108.1, at locations indicated to receive tile, with joints treated to comply with ANSI A108.11.

B. Water-Resistant Backing Board: Install at areas not subject to wetting and elsewhere as indicated with 1/4-inch gap where panels abut other construction or penetrations.

C. Where tile backing panels abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.

3.10 FINISHING GYPSUM BOARD

A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.

B. Prefill open joints, rounded or beveled edges, and damaged surface areas.

C. Apply joint tape over gypsum board joints, except those with trim having flanges not intended for tape.

D. Gypsum Board Finish Levels: Finish panels to levels indicated below:

1. Level 1: Ceiling plenum areas and concealed areas not exposed to view.
2. Level 2: Panels that are substrate for tile.
3. Level 4: Panel surfaces that will be exposed to view (typical panels).
4. Level 5: Where indicated on Drawings.

3.11 INSTALLING IDENTIFICATION FOR FIRE- AND SMOKE-PARTITIONS

A. Marking and Identification for Fire- and Smoke-Partitions: Permanently install as required by Code.

3.12 PROTECTION

A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

B. Remove and replace panels that are wet, moisture damaged, or exhibit mold growth. Repair of damaged panels in place is not acceptable.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION

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SECTION 09510

ACOUSTICAL CEILINGS

PART 1 - GENERAL

1.01 GENERAL PROVISIONS

A. 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.

1.02 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Acoustical ceiling tiles and panels.
2. Suspension systems, grid systems and ceiling hangars.
3. Acoustical sealant at edge moldings at acoustical ceilings.

B. Related Work: The following items are not included in this Section and are specified under the designated Sections:

1. Section 09211 – GYPSUM BOARD ASSEMBLIES for gypsum board ceilings and soffits.
2. Division 15 – HEAVING, VENTILATING AND AIR CONDITIONING for air handling and distribution components located in ceilings.
3. Division 16 – ELECTRICAL for light fixtures and alarm system components for installation in gypsum board assemblies.

1.03 SUBMITTALS

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

B. Coordination Drawings: Reflected ceiling plans drawn to sale and coordinating penetrations and ceiling-mounted items. Show the following:
1. Ceiling suspension members.
2. Method of attaching hangars to building structure. Furnish layouts for cast-in-place anchors, clips and other ceiling attachments devices whose installation ins specified in other Sections.
3. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels and special moldings.
4. Minimum Drawing Scale: ¼ inch = 1 foot.

C. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of size indicated below.
   1. Acoustical Panel: Set of 6 inch square Samples of each type, color, pattern, and texture.
   2. Exposed Suspension System Members, Moldings, and Trim: Set of 12 inch long Samples of each type, finish, and color.

D. Asbestos Certification: Manufacturer's written certification that acoustical ceilings products contain no asbestos (0.0000%). Product labels indicating that it is the user's responsibility to test the products for asbestos are unacceptable and sufficient cause for rejection of the product on site.

E. Maintenance Data: For finishes to include in maintenance manuals.

1.04 QUALITY ASSURANCE

A. Source Limitations:
   1. Acoustical Ceiling Panels: Obtain each type through one source from a single manufacturer.
   2. Suspension Systems: Obtain each type through one source from a single manufacturer.

B. Fire-Test-Response Characteristics: Provide acoustical panel ceilings that comply with the following requirements:
   1. Fire-Resistance Characteristics: Where indicated, provide acoustical panel ceilings identical to those of assemblies tested for fire resistance per ASTM E 119 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
      a. Fire-resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory" or from the listings of another testing and inspecting agency.
      b. Identify materials with appropriate markings of applicable testing and inspecting agency.
   2. Surface-Burning Characteristics: Provide acoustical panels complying with ASTM E 1264 for Class A materials as determined by testing identical products per ASTM E 84.

1.05 DELIVER, STORAGE, AND HANDLING

A. Deliver acoustical panels, suspension system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.

C. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

1.06 PROJECT CONDITIONS

A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

1.07 COORDINATION

A. Coordinate layout and installation of acoustical panels and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

PART 2 - PRODUCTS

2.01 ACOUSTICAL PANELS, GENERAL

A. Products: Subject to compliance with specified requirements, provide one of the following products for each type indicated.

B. ACT-1: General use and as indicated.
1. Manufacturer and Model Number:
   a. USG RADAR™ Ceramic acoustical panels
   b. Certainteed Ceilings, Symphony F RX. 1422-RXS-1.
   c. Armstrong, Ceramaguard .
2. Panel Size: 24 inches by 24 inches by 3/4 inch.
3. Panel Mounting: Revealed edge.
4. Noise Reduction Coefficient (NRC): Not less than 0.70.
5. Ceiling Attenuation Class (CAC): Not less than 35.
6. Color: White.
7. Grid Material: Painted steel.
8. Grid Face Width: 9/16 inch

2.02 METAL SUSPENSION SYSTEMS

A. Metal Suspension System Standard: Provide manufacturer's standard direct-hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635.
1. Manufacturer: USG, Armstrong, Certainteed Ceilings, or Chicago Metallic.
2. Structural Classification: Intermediate-duty system.
3. End Condition of Cross Runners: Override (stepped) or butt-edge type.
4. Face Design: Flat, flush.
5. Cap Material: Steel or aluminum cold-rolled sheet.
6. Color: White, prefinished.

7. Grid Face Width: As specified with ACT type. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.0625-inch-diameter wire, or double strand of 0.0475-inch-diameter wire.

B. Attachment Devices: Size for five times the design load indicated in ASTM C635, Table 1, "Direct Hung", unless otherwise indicated.

1. Anchors: Fabricated from corrosion-resistant materials with holes or loops for attaching wire hangers and capable of sustaining, without failure, a load equal to 5 times that imposed by construction as determined by testing according to ASTM E 488 by an independent testing agency.

a. Type: Vertical Bar joist clips.

C. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:
1. Zinc-Coated Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
2. Size: Select wire diameter so its stress at three times hanger design load (ASTM C 635, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 0.106 diameter wire.

D. Hold-Down Clips: at vestibules and areas subject to wind uplift, provide manufacturer's standard hold-down clips spaced 24 inches on all cross tees.

2.03 METAL EDGE MOLDINGS AND TRIM

A. Roll-Formed Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that fit acoustical panel edge details and suspension systems indicated; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension system runners.
1. For lay-in panels with reveal edge details, provide stepped edge molding that forms reveal of same depth and width as that formed between edge of panel and flange at exposed suspension member.
2. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.
3. For narrow-face suspension systems, provide suspension system and manufacturer's standard edge moldings that match width and configuration of exposed runners.

B. Suspension Trim: Subject to compliance with requirements, provide one of the following:
1. Armstrong World Industries, Inc.; Axiom.
2. CertainTeed Ceilings; Approved equal.
3. USG Interiors, Inc.; Compasso.

2.04 ACOUSTICAL SEALANT

A. Acoustical Sealant for Concealed Joints: Manufacturer's standard nondrying, nonhardening, nonskinning, nonstaining, gunnable, synthetic-rubber sealant, with a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24) recommended for sealing interior concealed joints to reduce airborne sound transmission.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.

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

3.02 PREPARATION

A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and comply with layout shown on reflected ceiling plans.

3.03 INSTALLATION

A. General: Install acoustical panel ceilings to comply with ASTM C 636 per manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."

B. Suspend ceiling hangers from building's structural members and as follows:
   1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
   2. Splay hangers only when required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying or other equally effective means.
   3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.
   4. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
   5. Do not support ceilings directly from permanent metal forms or roof deck.

6. Fasten hangers to bar joists.
7. Do not attach hangers to steel deck tabs.
8. Space hangers not more than 48 o.c. along each member supported directly from hangers, unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.

C. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.
1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
2. Screw attach moldings to substrate at intervals not more than 16 inches o.c. and not more than 3 inches from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet. Miter corners accurately and connect securely.
3. Do not use exposed fasteners, including pop rivets, on moldings and trim.

D. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

E. Install acoustical panels with undamaged edges and fit accurately into suspension system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.
1. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.
2. Install hold-down clips in areas indicated, in areas required by authorities having jurisdiction, and for fire-resistance ratings; space as recommended by panel manufacturer's written instructions, unless otherwise indicated.

3.04 CLEANING

1. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION

SECTION 09671

RESINOUS FLOORING

PART 1 - GENERAL

1.01 GENERAL PROVISIONS

A. 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.

1.02 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Epoxy flooring systems.

B. Related Work: The following items are not included in this Section and are specified under the designated Sections:

1. Section 07920 - JOINT SEALANTS for sealants installed at joints in resinous flooring systems.

1.03 SUBMITTALS

A. Product Data: For each type of product indicated. Include manufacturer's technical data, application instructions, and recommendations for each resinous flooring component required.

B. Shop Drawings: Provide floor plans, to scale matching Architectural Plans, which indicate extent of each different resinous flooring system including system type, color and pattern, degree of slip resistance, and dimensioned locations of control joints and seams where systems meet.

1. Provide enlarged details, at minimum 3 inch = 1 foot scale, indicating conditions at walls, door frames, pits, curbs, equipment pedestals, etc.

C. Samples for Verification: For each resinous flooring system required, 6 inches square, applied to a rigid backing by Installer for this Project.

D. Material Certificates: For each resinous flooring component, signed by manufacturer.

E. Installer Certificates: Signed by manufacturer certifying that installers comply with specified requirements.

F. Maintenance Data: For resinous flooring to include in maintenance manuals.

G. Test Results: For field testing of substrate, signed by installer.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer (applicator) who is experienced in applying resinous flooring systems similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance, and who is acceptable to resinous flooring manufacturer.

1. Contractor shall be a pre-qualified and "Approved Applicator" at the time of bid submittal with 5 years minimum experience.
2. Each approved applicator shall have been pre-qualified in all phases of surface preparation and application of the specified floor coating system.

B. Source Limitations: Obtain primary resinous flooring materials, including primers, resins, hardening agents, grouting coats, and topcoats, through one source from a single manufacturer. Provide secondary materials, including patching and fill material, joint sealant, and repair materials, of type and from source recommended by manufacturer of primary materials.

C. Pre-installation Conference: Prior to installation of flooring, meet at the Project site with the Manufacturer's Representative, the Installer, the Engineer, the Owner's Representative and the Owner's Testing Agency. Record discussions and furnish copy to each participant. Topics to be discussed shall include, but not be limited to:

1. Existing and new slab conditions
2. Owner's Testing Agency results of mandatory testing
3. Surface preparation
4. Required room temperatures
5. Ventilation
6. Step-by-step application procedures
7. Curing time and methods
8. Protection of completed Work

D. Testing:

1. ASTM E 1907 Standard Guide to Methods of Evaluating Moisture Conditions of Concrete Floors to Receive Resilient Floor Coverings
    a. ASTM F 1869 Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Sub-floor Using Anhydrous Calcium Chloride
    b. ASTM D 4263 Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method
    c. ASTM F 2170 Standard Test Method for Determining Relative Humidity in Concrete Slabs Using in situ Probes

2. ASTM F 710 Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring
3. ASTM D 4501 Standard Test Method for Shear Strength of Adhesive Bonds Between Rigid Substrates by the Block-Shear Method

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original packages and containers, with seals unbroken, bearing manufacturer's labels indicating brand name and directions for storage and mixing with other components.

B. Store materials to prevent deterioration from moisture, heat, cold, direct sunlight, or other detrimental effects.

1.06 PROJECT CONDITIONS

A. Environmental Limitations: Comply with resinous flooring manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting resinous flooring application.

1. Maintain ambient air temperature between 65oF and 85oF.
2. Type I Concrete substrate shall be properly cured for a minimum of 30 days. Type III Concrete shall be properly cured for a minimum of 7 days.

B. Lighting: Provide permanent lighting or, if permanent lighting is not in place, simulate permanent lighting conditions during resinous flooring application.

C. Close spaces to traffic during resinous flooring application and for not less than 24 hours after application, unless manufacturer recommends a longer period.

1.07 WARRANTY

A. Manufacturer shall furnish a single, written warranty covering 100% of the material a period of three (3) years from date of installation. Epoxy flooring installer will provide a written warranty covering 100% of the labor costs protecting the client from delamination, disbondment, and osmotic / hydrostatic failure for a period of three (3) years from date of installation.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

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

1. Crossfield Products Corp.
2. Stonhard, Inc.

3. Tnemec Company Inc.
4. Approved equal.

B. VOC Content of Liquid-Applied Flooring Components: Mot more than 100 g/L when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

2.02 RESINOUS FLOORING SYSTEM

1. Nominal 1/8th inch 100% Solids MVT Urethane Broadcast system with Novolac Chemical Resistant Epoxy topcoat. Basis-of Design Product: Tnemec Series 241 MVT / 282 Tneme-Glaze System

B. System Characteristics:

1. Color: As selected by Engineer from manufacturer's full range.
2. Wearing Surface: Textured for slip resistance.
3. Integral Cove Base: 4 inches high with 1 inch cant cove.
4. Overall System Thickness: Nominal 1/8th / inch (including osmotic pressure barrier or grout).
5. VOC: Less than 100 g/l.

C. Components: Multi-layered slurry applied flooring surfacing system shall be composed of an MVT primer coat with full sand broadcast to rejection., and full finish coats, and shall conform to the following standards:

D. Meet the following minimum standards for physical characteristics.

1. Compressive Strength: ASTM C-579, 10,000 psi
2. Tensile Strength: ASTM C-307, 1,500 – 1,600 psi
3. Flammable Properties: ASTM D-635, * Tested Self-Extinguishing – Class I
4. Impact Resistance: MIL-D-3134, Para 4.7.3 Indentation of 2# ball, 0.008", or 0.21%.
5. Flexural Strength: ASTM C-790, 5200-5500 psi
6. Water Absorption: ASTM C413, 1.24%
7. Bond Strength: ASTM-D-4541, 1000 psi
8. Abrasion Resistance: ASTM D-4060 (CS17 Wheel), No more than 67 mg loss
9. Surface Hardness: ASTM D-2240, Shore "D" 85
10. Modulus of Elasticity: No less than 2900 psi flex, ASTM D-580, no less than 822,000 psi elasticity
11. Volatile organic compounds limitations: Meet all state requirements.
12. Slip - Resistance: Provide minimum of 0.6 to comply with ADA.

E. System Components: Manufacturer's standard components which are compatible with each other and as follows:

2.03 ACCESSORY MATERIALS

A. Patching and Fill Material: Tnemec Series 215 Surfacing Epoxy or approved equal by resinous flooring manufacturer to fill voids, cracks, bugholes, and other surface defects.

PART 3 - EXECUTION

3.01 PREPARATION

A. General: Prepare and clean substrates according to resinous flooring manufacturer's written instructions for substrate indicated. Provide clean, dry, and neutral Ph substrate for resinous flooring application.

B. Concrete Substrates: Provide sound concrete surfaces free of laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants incompatible with resinous flooring.

1. Roughen concrete substrates as follows:
   a. Shot-blast or mechanically scarify surfaces with an apparatus that abrades the concrete surface, contains the dispensed shot within the apparatus, and recirculates the shot by vacuum pickup.
   b. Comply with SSPC-SP13 Surface Preparation of Concrete. Reference ICRI CSP 4-5 Visual Standards. .
2. Repair damaged and deteriorated concrete according to resinous flooring manufacturer's written recommendations.
3. Verify that concrete substrates are dry.
   a. Perform anhydrous calcium chloride test, ASTM F 1869 or Relative Humidity tests in accordance with ASTM F 2170 “Standard Test Method for Determining Relative Humidity in Concrete using in situ Probes”. Proceed with application only after substrates have maximum moisture-vapor-emission rate as required by the manufacturer.
   b. Perform additional moisture tests recommended by manufacturer (if required). Proceed with application only after substrates pass testing.

4. Verify that concrete substrates have neutral pH and that resinous flooring will adhere to them. Perform tests recommended by manufacturer. Proceed with application only after substrates pass testing.

C. Resinous Materials: Mix components and prepare materials according to resinous flooring manufacturer's written instructions.

D. Use patching and fill material to fill holes and depressions in substrates according to manufacturer's written instructions.

E. Treat control joints and other nonmoving substrate cracks to prevent cracks from reflecting through resinous flooring according to manufacturer's written recommendations.

3.02 APPLICATION

A. General: Apply components of resinous flooring system according to manufacturer's written instructions to produce a uniform, monolithic wearing surface of thickness indicated.

1. Coordinate application of components to provide optimum adhesion of resinous flooring system to substrate, and optimum intercoat adhesion.
2. Cure resinous flooring components according to manufacturer's written instructions. Prevent contamination during application and curing processes.
3. At substrate expansion and isolation joints, provide joint in resinous flooring to comply with resinous flooring manufacturer's written recommendations.
   a. Apply joint sealant to comply with manufacturer's written recommendations.

B. Apply 100% Solids MVT Urethane primer over prepared substrate at manufacturer's recommended spreading rate.

C. Cant Cove: Apply cant cove to wall surfaces before applying flooring. Apply according to manufacturer's written instructions and details including those for taping, mixing, priming, troweling, sanding, and topcoating of cant cove . Round internal and external corners.

D. Apply 100% Solids Novolac Epoxy topcoat(s) in number of coats indicated for flooring system and at spreading rates recommended in writing by manufacturer. A second coat may be necessary depending on desired texture.

3.03 COATING SCHEDULE

A.	Primer/MVT Coat:	Tnemec Series 241 MVT, or approved equal; 100% Solids Urethane resin with 30/50 mesh sandbroadcast to rejection at a nominal 1/8”
B.	Topcoat:	Tnemec Series 282, or approved equal; Pigmented 100% Solids Novolac Epoxy at 8-12 mils DFT.
C.	Second Topcoat	Tnemec Series 282, or approved equal; Pigmented 100% Solids Novolac Epoxy at 8-12 mils DFT.

3.04 CLEANING AND PROTECTING

E. Protect resinous flooring from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by resinous flooring manufacturer.

END OF SECTION

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SECTION 09900

PAINTING AND COATING

PART 1 - GENERAL

1.01 GENERAL PROVISIONS

A. 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.

1.02 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Field painting of exposed interior items and surfaces.
2. Field painting of exposed exterior items and surfaces.
3. Surface preparation for painting.

B. Related Work: The following items are not included in this Section and are specified under the designated Sections:

1. Section 05120 - STRUCTURAL STEEL FRAMING for shop priming structural steel.
2. Section 05500 - METAL FABRICATIONS for shop priming ferrous metal.
3. Section 06402 - INTERIOR ARCHITECTURAL WOODWORK for shop priming interior architectural woodwork.
4. Section 08111 - HOLLOW METAL DOORS AND FRAMES for factory priming steel doors and frames.
5. Section 09211 - GYPSUM BOARD ASSEMBLIES for surface preparation of gypsum board.

1.03 DEFINITIONS AND EXTENT

A. General: Standard coating terms defined in ASTM D 16 apply to this Section.

1. Flat refers to a lusterless or matte finish with a gloss range below 15 when measured at an 85-degree meter.
2. Eggshell refers to low-sheen finish with a gloss range between 20 and 35 when measured at a 60-degree meter.
3. Semigloss refers to medium-sheen finish with a gloss range between 35 and 70 when measured at a 60-degree meter.
4. Full gloss refers to high-sheen finish with a gloss range more than 70 when measured at a 60-degree meter.

B. This Section includes surface preparation and field painting of exposed exterior and interior items and surfaces.

1. Surface preparation, priming, and finish coats specified in this Section are in addition to shop priming and surface treatment specified in other Sections.

C. Paint exposed surfaces, except where these Specifications indicate that the surface or material is not to be painted or is to remain natural. If an item or a surface is not specifically mentioned, paint the item or surface the same as similar adjacent materials or surfaces. If a color of finish is not indicated, Engineer will select from standard colors and finishes available.

1. Painting includes field painting of exposed bare and covered pipes and ducts (including color coding), hangers, exposed steel and iron supports, and surfaces of mechanical and electrical equipment that do not have a factory-applied final finish.

D. Do NOT paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels.

1. Prefinished items include the following factory-finished components:

a. Architectural woodwork.
b. Metal lockers.
c. Kitchen appliances.
d. Finished mechanical and electrical equipment.
e. Light fixtures.

2. Concealed surfaces include walls or ceilings in the following generally inaccessible spaces:

a. Foundation spaces.
b. Furred areas.
c. Ceiling plenums.
d. Utility tunnels.
e. Pipe spaces.
f. Duct shafts.
g. Elevator shafts.

3. Finished metal surfaces include the following:

a. Anodized aluminum.
b. Stainless steel.
c. Chromium plate.
d. Copper and copper alloys.
e. Bronze and brass.

4. Operating parts include moving parts of operating equipment and the following:

a. Valve and damper operators.
b. Linkages.
c. Sensing devices.
d. Motor and fan shafts.

5. Labels: Do not paint over UL, FMG, or other code-required labels or equipment name, identification, performance rating, or nomenclature plates.

1.04 SUBMITTALS

A. Product Data: For each paint system indicated. Include block fillers and primers.

1. Material List: An inclusive list of required coating materials. Indicate each material and cross-reference specific coating, finish system, and application. Identify each material by manufacturer's catalog number and general classification.
2. Manufacturer's Information: Manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each coating material.

B. Samples for Verification: For each color and material to be applied, with texture to simulate actual conditions, on representative Samples of the actual substrate.

1. Provide stepped Samples, defining each separate coat, including block fillers and primers. Use representative colors when preparing Samples for review. Resubmit until required sheen, color, and texture are achieved.
2. Provide a list of materials and applications for each coat of each Sample. Label each Sample for location and application.
3. Submit two eight inch by 12 inch Samples for each type of finish coating for Engineer's review of color and texture only.

a. After finishes are accepted, Engineer will use the Sample to evaluate coating systems of a similar nature.

4. Final approval of colors will be from Samples.

C. Qualification Data: For Applicator.

1.05 QUALITY ASSURANCE

A. Applicator Qualifications: A firm or individual experienced in applying paints and coatings similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance.

B. Source Limitations: Obtain block fillers and primers for each coating system from the same manufacturer as the finish coats.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label and the following information:

1. Product name or title of material.
2. Product description (generic classification or binder type).
3. Manufacturer's stock number and date of manufacture.
4. Contents by volume, for pigment and vehicle constituents.
5. Thinning instructions.
6. Application instructions.
7. Color name and number.
8. VOC content.

B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg F. Maintain storage containers in a clean condition, free of foreign materials and residue.

1. Protect from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily.

1.07 PROJECT CONDITIONS

A. Apply waterborne paints only when temperatures of surfaces to be painted and surrounding air are between 50 and 90 deg F.

B. Apply solvent-thinned paints only when temperatures of surfaces to be painted and surrounding air are between 45 and 95 deg F.

C. Do not apply paint in snow, rain, fog, or mist; or when relative humidity exceeds 85 percent; or at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

1. Painting may continue during inclement weather if surfaces and areas to be painted are enclosed and heated within temperature limits specified by manufacturer during application and drying periods.

1.08 EXTRA MATERIALS

A. Furnish extra materials that match and are from same production runs as products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Paint: Furnish two unopened gallons of each type of paint and coating work, in color and gloss as used for the Project.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work are listed in the Finish Schedule at the end of this Section.

2.02 PAINT MATERIALS, GENERAL

A. Material Compatibility: Provide block fillers, primers, and finish-coat materials that are compatible with one another and with the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

B. Material Quality: Provide manufacturer's best-quality paint material of the various coating types specified that are factory formulated and recommended by manufacturer for application indicated. Paint-material containers not displaying manufacturer's product identification will not be acceptable.

1. Proprietary Names: Use of manufacturer's proprietary product names to designate colors or materials is not intended to imply that products named are required to be used to the exclusion of equivalent products of other manufacturers. Furnish manufacturer's material data and certificates of performance for proposed substitutions.
2. Colors: As selected by Engineer.

C. VOC Content for Interior Paints and Coatings: Products shall comply with VOC limits of authorities having jurisdiction and, for interior paints and coatings applied at Project site, the following VOC limits, exclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

1. Flat Paints and Coatings: 50 g/L.
2. Nonflat Paints and Coatings: 150 g/L.
3. Dry-Fog Coatings: 400 g/L.
4. Primers, Sealers, and Undercoaters: 200 g/L.
5. Anticorrosive and Antirust Paints Applied to Ferrous Metals: 250 g/L.
6. Zinc-Rich Industrial Maintenance Primers: 340 g/L.
7. Pretreatment Wash Primers: 420 g/L.
8. Floor Coatings: 100 g/L.
9. Shellacs, Clear: 730 g/L.
10. Shellacs, Pigmented: 550 g/L.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for paint application.

1. Proceed with paint application only after unsatisfactory conditions have been corrected and surfaces receiving paint are thoroughly dry.
2. Start of painting will be construed as Applicator's acceptance of surfaces and conditions within a particular area.

B. Coordination of Work: Review other Sections in which primers are provided to ensure compatibility of the total system for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.

1. Notify Engineer about anticipated problems when using the materials specified over substrates primed by others.

3.02 PREPARATION

A. General: Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items already installed that are not to be painted. If removal is impractical or impossible because of size or weight of the item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations in each space or area, reinstall items removed using workers skilled in the trades involved.

B. Cleaning: Before applying paint or other surface treatments, clean substrates of substances that could impair bond of the various coatings. Remove oil and grease before cleaning.

1. Schedule cleaning and painting so dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.

C. Surface Preparation: Clean and prepare surfaces to be painted according to manufacturer's written instructions and technical bulletins for each particular substrate condition and as specified.

1. Provide barrier coats over incompatible primers or remove and reprime.
2. Cementitious Materials: Prepare concrete, concrete unit masonry, cement plaster, and mineral-fiber-reinforced cement panel surfaces to be painted. Remove efflorescence, chalk, dust, dirt, grease, oils, and release agents. Roughen as required to remove glaze. If hardeners or sealers have been used to improve curing, use mechanical methods of surface preparation.

a. Use abrasive blast-cleaning methods if recommended by paint manufacturer.
b. Determine alkalinity and moisture content of surfaces by performing appropriate tests. If surfaces are sufficiently alkaline to cause the finish paint to blister and burn, correct this condition before application. Do not paint surfaces if moisture content exceeds that permitted in manufacturer's written instructions.
c. Clean concrete floors to be painted with a 5 percent solution of muriatic acid or other etching cleaner. Flush the floor with clean water to remove acid, neutralize with ammonia, rinse, allow to dry, and vacuum before painting.

3. Wood: Clean surfaces of dirt, oil, and other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Sand surfaces exposed to view smooth and dust off.

a. Scrape and clean small, dry, seasoned knots, and apply a thin coat of white shellac or other recommended knot sealer before applying primer. After priming, fill holes and imperfections in finish surfaces with putty or plastic wood filler. Sand smooth when dried.
b. Prime, stain, or seal wood to be painted immediately on delivery. Prime edges, ends, faces, undersides, and back sides of wood, including cabinets, counters, cases, and paneling.
c. If transparent finish is required, backprime with spar varnish.
d. Backprime paneling on interior partitions where masonry, plaster, or other wet wall construction occurs on back side.
e. Seal tops, bottoms, and cutouts of unprimed wood doors with a heavy coat of varnish or sealer immediately on delivery.

4. Ferrous Metals: Clean ungalvanized ferrous-metal surfaces that have not been shop coated; remove oil, grease, dirt, loose mill scale, and other foreign substances. Use solvent or mechanical cleaning methods that comply with SSPC's recommendations.
a. Exterior Exposed Steel: Clean steel surfaces in accordance with SSPC-SP 6/NACE No. 3 Commercial Blast Cleaning. Abrasive blast cleaned surfaces shall exhibit a uniform, angular profile of 1.5-3.0 mils. Prime cleaned surfaces within 8 hours and prior to surface rusting.
b. Interior Exposed Steel, in Humid Environments: Clean steel surfaces in accordance with SSPC-SP 6/NACE No. 3 Commercial Blast Cleaning. Abrasive blast cleaned surfaces shall exhibit a uniform, angular profile of 1.5-3.0 mils. Prime cleaned surfaces within 8 hours and prior to surface rusting.
c. Interior Exposed Steel, in Dry Environments: Clean steel surfaces in accordance with SSPC-SP2 or SP3 Hand or Power Tool Cleaning.

5. Galvanized Surfaces: Clean galvanized surfaces in accordance with SSPC-SP16 Brush off Blast Cleaning of Galvanized Steel and NonFerrous Metals, to achieve a minimum 1 mil anchor profile.

D. Material Preparation: Mix and prepare paint materials according to manufacturer's written instructions.

1. Maintain containers used in mixing and applying paint in a clean condition, free of foreign materials and residue.
2. Stir material before application to produce a mixture of uniform density. Stir as required during application. Do not stir surface film into material. If necessary, remove surface film and strain material before using.
3. Use only thinners approved by paint manufacturer and only within recommended limits.

E. Tinting: Tint each undercoat a lighter shade to simplify identification of each coat when multiple coats of same material are applied. Tint undercoats to match the color of the finish coat, but provide sufficient differences in shade of undercoats to distinguish each separate coat.

3.03 APPLICATION

A. General: Apply paint according to manufacturer's written instructions. Use applicators and techniques best suited for substrate and type of material being applied.

1. Paint colors, surface treatments, and finishes are indicated in the paint schedules.
2. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable paint film.
3. Provide finish coats that are compatible with primers used.
4. The term "exposed surfaces" includes areas visible when permanent or built-in fixtures, grilles, convector covers, covers for finned-tube radiation, and similar components are in place. Extend coatings in these areas, as required, to maintain system integrity and provide desired protection.
5. Paint surfaces behind movable equipment and furniture the same as similar exposed surfaces. Before final installation of equipment, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
6. Paint interior surfaces of ducts with a flat, nonspecular black paint where visible through registers or grilles.
7. Paint backsides of access panels and removable or hinged covers to match exposed surfaces.
8. Finish exterior doors and doors in wet areas on tops, bottoms, and side edges the same as exterior faces.
9. Sand lightly between each succeeding enamel or varnish coat.

B. Scheduling Painting: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.

1. The number of coats and film thickness required are the same regardless of application method. Do not apply succeeding coats until previous coat has cured as recommended by manufacturer. If sanding is required to produce a smooth, even surface according to manufacturer's written instructions, sand between applications.
2. Omit primer over metal surfaces that have been shop primed and touchup painted.
3. If undercoats, stains, or other conditions show through final coat of paint, apply additional coats until paint film is of uniform finish, color, and appearance. Give special attention to ensure that edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.
4. Allow sufficient time between successive coats to permit proper drying. Do not recoat surfaces until paint has dried to where it feels firm, and does not deform or feel sticky under moderate thumb pressure, and until application of another coat of paint does not cause undercoat to lift or lose adhesion.

C. Application Procedures: Apply paints and coatings by brush, roller, spray, or other applicators according to manufacturer's written instructions.

1. Brushes: Use brushes best suited for type of material applied. Use brush of appropriate size for surface or item being painted.
2. Rollers: Use rollers of carpet, velvet-back, or high-pile sheep's wool as recommended by manufacturer for material and texture required.
3. Spray Equipment: Use airless spray equipment with orifice size as recommended by manufacturer for material and texture required.

D. Minimum Coating Thickness: Apply paint materials no thinner than manufacturer's recommended spreading rate to achieve dry film thickness indicated. Provide total dry film thickness of the entire system as recommended by manufacturer.

E. Mechanical and Electrical Work: Painting of mechanical and electrical work is limited to items exposed in equipment rooms and occupied spaces.

F. Mechanical items to be painted include, but are not limited to, the following:

1. Uninsulated metal piping.
2. Uninsulated plastic piping.
3. Pipe hangers and supports.
4. Tanks that do not have factory-applied final finishes.
5. Visible portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets.
6. Duct, equipment, and pipe insulation having "all-service jacket" or other paintable jacket material.
7. Mechanical equipment that is indicated to have a factory-primed finish for field painting.
8. Process pipe.
9. Ductile iron.
10. PVC.

G. Electrical items to be painted include, but are not limited to, the following:

1. Switchgear.
2. Panelboards.
3. Electrical equipment that is indicated to have a factory-primed finish for field painting.

H. Block Fillers: Apply block fillers to concrete masonry block at a rate to ensure complete coverage with pores filled.

I. Prime Coats: Before applying finish coats, apply a prime coat, as recommended by manufacturer, to material that is required to be painted or finished and that has not been prime coated by others. Recoat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat appears, to ensure a finish coat with no burn-through or other defects due to insufficient sealing.

J. Pigmented (Opaque) Finishes: Completely cover surfaces as necessary to provide a smooth, opaque surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections will not be acceptable.

K. Transparent (Clear) Finishes: Use multiple coats to produce a glass-smooth surface film of even luster. Provide a finish free of laps, runs, cloudiness, color irregularity, brush marks, orange peel, nail holes, or other surface imperfections.

1. Provide satin finish for final coats.

L. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not complying with requirements.

3.04 FIELD QUALITY CONTROL

A. The Owner reserves the right to invoke the following test procedure at any time and as often as the Owner deems necessary during the period when paint is being applied:

1. The Owner will engage a qualified independent testing agency to sample paint material being used. Samples of material delivered to Project will be taken, identified, sealed, and certified in the presence of Contractor.
2. Testing agency will perform appropriate tests for the following characteristics as required by the Engineer.
3. The Engineer may direct Contractor to stop painting if test results show material being used does not comply with specified requirements. Contractor shall remove noncomplying paint from Project site, pay for testing, and repaint surfaces previously coated with the noncomplying paint. If necessary, Contractor may be required to remove noncomplying paint from previously painted surfaces if, on repainting with specified paint, the two coatings are incompatible.

3.05 CLEANING

A. Cleanup: At the end of each workday, remove empty cans, rags, rubbish, and other discarded paint materials from Project site.

1. After completing painting, clean glass and paint-spattered surfaces. Remove spattered paint by washing and scraping without scratching or damaging adjacent finished surfaces.

3.06 PROTECTION

A. Protect work of other trades, whether being painted or not, against damage from painting. Correct damage by cleaning, repairing or replacing, and repainting, as approved by Engineer.

B. Provide "Wet Paint" signs to protect newly painted finishes. After completing painting operations, remove temporary protective wrappings provided by others to protect their work.

1. After work of other trades is complete, touch up and restore damaged or defaced painted surfaces. Comply with procedures specified in PDCA P1.

3.07 PAINT SCHEDULE

A. Schedule: Provide products and number of coats specified. Use of manufacturer's proprietary product names to designate colors, materials, generic class, standard of quality and performance criteria and is not intended to imply that products named are required to be used to the exclusion of equivalent performing products of other manufacturers.

B. COLOR SCHEDULES

1. Architectural
   a. Chosen by Owner.
2. Piping

a.	Water lines	Raw.....Olive Green
		Settled or Clarified.....Aqua
		Finished or Potable.....Dark Blue
b.	Chemical Lines	Alum.....Orange
		Caustic.....Yellow with Green Band
		Chlorine.....Yellow
		Fluoride.....Light Blue with Red Band
		Polymers.....Orange with Green Band
		Potassium Permanganate..Violet
c.	Waste Lines	Raw.....Gray
		Sludge.....Brown
d.	Miscellaneous	Compressed Air.....Dark Green
		Fuel Oil.....Red

C. Exterior Paint Schedule:

1. Exterior Galvanized Metal (not shop-finished under Section 05120 - STRUCTURAL STEEL FRAMING, Section 05500 - METAL FABRICATIONS, or Section 05530 – METAL GRATINGS), Alliphatic Acrylic Polyurethane System:

   a. Surface Preparation: SSPC-SP16 Brush-off Blast of Galvanized Steel.
   b. One Coat:

      1) Sherwin Williams Macropoxy 646 + Curing Compound B58 Epoxy
      2) Tnemec 66HS Hi-Build Epoxoline at 3.0 mils DFT.
      3) PPG PMC Amerlock 400 Hi-Build Epoxy at 4.0-5.0 mils DFT.
      4) Dupont 25P High Solids at 4.0 mils DFT.

   c. And One Coat:

      1) Sherwin Williams Acrolon 218 - B65.
      2) Tnemec 73 Endura-Shield at 3.0 mils DFT.
      3) PPG PMC Amercoat 450H Polyurethane at 3.0 mils DFT.
      4) Dupont Imron 2.8 Urethane at 3.0 to 4.0 mils DFT.

2. Exterior Ferrous Metal, Urethane System:

   a. Surface Preparation: SSPC-SP6.
   b. One Coat:

      1) Tnemec Zinc-Rich Primer; shop applied under other Sections; use for touch up.
      2) PPG PMC Amercoat 68 MCZ at 3 mils DFT; shop applied under other Sections; use for touch up
      3) Dupont Urethane Ganicin Zinc Rich Primer 80%zinc load at 3.0 mils DFT.

   c. And One Coat:

      1) Tnemec N69/66HS Hi-Build Epoxoline at 3.0 mils DFT.
      2) PPG PMC Amerlock 400 Hi-Build Epoxy at 3.0 to 5.0 mils DFT.
      3) Dupont 25P High Solids Epoxy at 4.0 to 6.0 mils DFT.

   d. And One Coat:

      1) Tnemec 73 Endura-Shield at 3.0 mils DFT.
      2) PPG PMC Amerlock 450H Polyurethane Topcoat at 3.0 mils DFT.
      3) Dupont High Solids Imron Urethane at 4.0 mils DFT.

3. Exterior Aluminum, Painted Finish:

a. Surface Preparation: Pressure wash with Oakite and sand with 3M Scotch-Brite nylon pads.
b. One Coat:

1) Tnemec N69/66HS Hi-Build Epoxoline at 2.0 mils DFT.
2) PPG PMC Amerlock 400 Hi-Build Epoxy at 2.0 to 3.0 mils DFT.
3) Dupont 25P High Solids at 4.0 mils DFT.

c. And One Coat:

1) Tnemec 73 Endura-Shield at 2.0 mils DFT.
2) PPG PMC Amercoat 450H Polyurethane at 3.0 mils DFT.
3) Dupont High Solids Imron 2.8 at 4.0 mils DFT.

D. Interior Paint Schedule:

1. Interior Gypsum Wallboard, Latex Paint Finish:

a. One Coat, Primer:
1) Moore Eco Spec WB Interior Latex Primer 372.
2) Duron Genesis Latex Primer.
3) S-W ProMar 200 Zero-VOC Latex Wall Primer.
4) PPG Pure Performance Latex Primer.
5) California Paint Envirotech Zero VOC Primer 646. And One Coat:

b. And Two Coats, Eggshell Finish: At walls and elsewhere indicated.
1) Moore Eco Spec WB Interior Latex Flat 374.
2) Duron Genesis Latex Flat.
3) S-W ProMar 200 Zero-VOC Latex Flat.
4) PPG Pure Performance Latex Eggshell.
5) California Paint Envirotech Zero VOC Flat 633.

2. Interior Architectural Woodwork, Finish Carpentry, Latex Paint Finish:

a. One Coat, Primer:

1) Moore Eco Spec WB Interior Latex Primer 372.
2) Duron Genesis Latex Primer.
3) S-W ProMar 200 Zero-VOC Latex Primer.
4) PPG Pure Performance Latex Primer.
5) California Paint Envirotech Zero VOC Primer 646.

b. And Two Coats, Semi-Gloss:

1) Moore Eco Spec WB Interior Latex Semi-Gloss 376.
2) Duron Genesis Latex Semi-Gloss.
3) S-W ProMar 200 Zero VOC Latex Semi-Gloss.
4) PPG Pure Performance Latex Semi-Gloss.

5) California Paint Envirotech Zero VOC Semi Gloss 663.

3. Interior Concrete Masonry Units, Epoxy/Urethane Coating:

a. Surface Preparation: Cured, clean and dry, free of surface contaminants.

b. One Coat:

1) Tnemec 875 Block Filler at 100 sqft/gal.
2) PPG PMC Nu-Klad 965 at 100 sqft/gal.
3) Dupont 25P at 100 sq/ft/gal.

c. And One Coat:

1) Sherwin-Williams Cor-Cote B62.
2) Tnemec 280 Tneme-Glaze at 6.0 8.0 mils DFT.
3) PPG PMC Amercoat 351 6.0 to 8.0 mils DFT.
4) Dupont 100% Solids Epoxy at 7.0 to 9.0 mils DFT.

d. And One Coat:

1) Sherwin Williams Waberbased Acroban B65 Polyurethane 100.
2) Tnemec 1080 or 1081 EnduraShield at 3.0 to 4.0 mils DFT.
3) PPG PMC AmerShield VOC at 3.0 to 4.0 mils DFT.
4) Dupont Imron WB Urethane at 3.0 to 4.0 mils DFT.

4. Interior Metals (Not specified to receive other coating systems/not shop finished), Epoxy Painted Finish:

a. One Coat: Approved primer, in shop under other Sections (where specified). If not shop primed, provide primer recommended by finish coating manufacturer.

b. And One Coat:

1) Sherwin Williams Sher-Cryl HPA High Performance Acrylic.
2) Tnemec 1029 Enduratone at 2.0 mils DFT.
3) PPG PMC Amerlock 400 at 2.0 to 4.0 mils DFT.
4) Dupont 25P at 3.0 to 4.0 mils DFT.

c. And One Coat:

1) Sherwin Williams Sher-Cryl HPA High Performance Acrylic.
2) Tnemec 1029 Enduratone at 2.0 to 3.0 mils DFT.
3) PPG PMC Amerlock 400 at 2.0 to 4.0 mils DFT.
4) Dupont High Solids Acrylic Coating 3.0 mils DFT.

5. Interior Exposed Steel, Joists, Ductwork, Conduit and Similar Items (where indicated), Dry-Fall or Dry-Fog Spray Applied System:

    a. One Coat:

        1) Tnemec 115 WB Unibond at 2.5 to 3.0 mils DFT.
        2) PPG PMC Amercoat 220 Acrylic at 3.0 mils DFT.
        3) International Intercryl 530 at 2.5 to 3.0 mils DFT.
        4) RD Coatings Muracryl at 2.0 to 3.0 mils DFT.

6. Concrete Floor, Epoxy/Resinous Flooring: under Section 09671-RESINOUS FLOORING.

7. PVC Piping:

    a. Surface preparation: Scarify prior to coating.
    b. 1st coat: Tnemec Series 66 Epoxoline or approved equal, DFT 1.5 to 2.0 mils.
    c. 2nd coat: Tnemec Series 66 Epoxoline or approved equal, DFT 1.5 to 2.0 mils.

8. Ductile Iron Piping:

    a. Surface preparation: Immersion Service-SSPC-SP-10
    b. 1st coat: (Shop Applied) Tnemec Series 66-1211, DFT. 3.0 mils.
    c. 2nd coat: (Field Applied) Tnemec 66, Color, DFT 4.0 mils.
    d. 3rd coat (Field Applied) Tnemec Series 66 Color DFT 4.0 mils.

9. Carbon Steel Piping:

    a. Surface preparation: Immersion Service- SSPC-SP-10.
    b. 1st coat: (Shop Applied) Tnemec Series 66-1211, DFT. 3.0 mils.
    c. 2nd coat: (Field Applied) Tnemec 66, Color, DFT 4.0 mils.
    d. 3rd coat (Field Applied) Tnemec Series 66 Color DFT 4.0 mils.

10. Canvas and Cotton Insulation Coverings.

    a. 1st coat: Tnemec 51-792 Sealer.
    b. 2nd coat: Tnemec Series 6 Tneme Cryl.
    c. 3nd coat: Tnemec Series 6 or Series 7 Tneme Cryl.

11. Miscellaneous Mechanical and Electrical Work: Paint all exposed items throughout the project except factory finished items with factory-applied baked enamel finishes which occur in mechanical rooms or areas, and excepting chrome or nickel plating, stainless steel, and aluminum other than mill finished. Paint all exposed ductwork and inner portion of all ductwork. Same as specified for other interior metals, hereinabove.

END OF SECTION

DIVISION 10

SECTION 10140

SIGNAGE

PART 1 - GENERAL

1.01 GENERAL PROVISIONS

A. 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.

1.02 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Code-required interior panel signage, including but not limited to, accessibility signage, toilet room signage and mechanical and electrical room signage.
2. Interior room name and number signs.
3. New interior cast bronze memorial dedication plaque.
4. Restoration, cleaning and relocation of existing interior cast bronze dedication plaque.
5. Site harvest, restoration, cleaning, and reinstallation of existing main entrance building sign (Framingham, Water Works).
6. Building name and location / address signs including curb cut / street location and building mounted location.

B. Related Work: The following items are not included in this Section and are specified under the designated Sections:

1. Division 16 - ELECTRICAL for illuminated exit signs.

1.03 SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of sign.

B. Shop Drawings: Include plans, elevations, and large-scale sections of typical members and other components. Show mounting methods, grounds, mounting heights, layout, spacing, reinforcement, accessories, and installation details.

1. Provide message list for each sign, including large-scale details of wording, lettering, artwork, and braille layout.

C. Samples for Verification: For each type of sign, include the following Samples to verify color selected:

1. Panel Signs: Full-size Samples of each type of sign required.
2. Approved samples will not be returned for installation into Project.

D. Maintenance Data: For signage cleaning and maintenance requirements to include in maintenance manuals.

1.04 QUALITY ASSURANCE

A. Source Limitations: Obtain each sign type through one source from a single manufacturer.

B. Regulatory Requirements: Comply with the Massachusetts Architectural Access Board, Americans with Disabilities Act (ADA) and with code provisions as adopted by authorities having jurisdiction.

1.05 PROJECT CONDITIONS

A. Field Measurements: Where sizes of signs are determined by dimensions of surfaces on which they are installed, verify dimensions by field measurement before fabrication and indicate measurements on Shop Drawings.

1.06 COORDINATION

A. For signs supported by or anchored to permanent construction, advise installers of anchorage devices about specific requirements for placement of anchorage devices and similar items to be used for attaching signs.

PART 2 - PRODUCTS

2.01 PANEL SIGNS

A. General: Provide signs that comply with requirements indicated for materials, thicknesses, finishes, colors, designs, shapes, sizes, and details of construction as indicated. Produce smooth panel sign surfaces constructed to remain flat under installed conditions within tolerance of plus or minus 1/16 inch measured diagonally. Provide the following:

1. Interior Panel Signs:
    a. Type: Photopolymer on acrylic or printed acrylic as applicable.
    b. Color: Custom color as selected.
    c. Type Size: As selected.
    d. Typeface: As selected.
2. Specialty Signs:
    a. Dedication Plaques:
        1) General: Provide castings free from pits, scale, sand holes, and other defects. Comply with requirements specified for metal, border style,

background texture, and finish and in required thickness, size, shape, and copy.

2) Dimensions and Configuration: Refer to drawings.
3) Location: As selected by Engineer.
4) Thickness: Not less than 3/8 inch (9 mm).
5) Material: Cast bronze.
6) Letters: Raised letters with polished faces in type face selected by Engineer.
7) Text: Layout and design, including border, will be provided by Engineer in camera-ready form.
8) Finish:
   a) Raised areas: Hand-tool and buff borders and raised copy to produce manufacturer's standard satin finish.
   b) Background finish: Painted.
9) Cast metal plaques shall be installed by means of concealed, vandal-resistant fastening method at interior location selected by Engineer.

B. Tactile and Braille Copy: Manufacturer's standard process for producing copy complying with ADA Accessibility Guidelines and ICC/ANSI A117.1. Text shall be accompanied by Grade 2 braille. Produce precisely formed characters with square cut edges free from burrs and cut marks.

1. Raised-Copy Thickness: Not less than 1/32 inch

C. Symbols of Accessibility: Provide 6-inch- high symbol fabricated from opaque nonreflective vinyl film, 0.0035-inch nominal thickness, with pressure-sensitive adhesive backing suitable for both exterior and interior applications.

2.02 ACCESSORIES

A. Panel Sign Mounting Methods: Use double-sided vinyl tape fabricated from materials that are not corrosive to sign material and mounting surface.

B. Anchors and Inserts: Provide nonferrous-metal or hot-dip galvanized anchors and inserts for exterior installations and elsewhere as required for corrosion resistance. Use toothed steel or lead expansion-bolt devices for drilled-in-place anchors. Furnish inserts, as required, to be set into concrete or masonry work.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.

B. Verify that items provided under other sections of Work are sized and located to accommodate signs.

C. Examine supporting members to ensure that surfaces are at elevations indicated or required to comply with authorities having jurisdiction and are free from dirt and other deleterious matter.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION, GENERAL

A. General: Locate signs and accessories where indicated, using mounting methods of types described and in compliance with manufacturer's written instructions.

1. Install signs level, plumb, and at heights indicated, with sign surfaces free from distortion and other defects in appearance.
2. Interior Wall Signs: Install signs on walls adjacent to latch side of door where applicable. Where not indicated or possible, such as double doors, install signs on nearest adjacent walls. Locate to allow approach within 3 inches of sign without encountering protruding objects or standing within swing of door.

B. Wall-Mounted Panel Signs: Attach panel signs to wall surfaces using methods indicated below:

1. Vinyl-Tape Mounting: Use double-sided foam tape to mount signs to smooth, nonporous surfaces. Do not use this method for vinyl-covered or rough surfaces.

3.03 INSTALLATION OF CAST METAL PLAQUES

A. Cast-Metal Plaques: Mount plaques using standard concealed fastening methods recommended in writing by manufacturer for type of wall surface indicated.

B. Concealed Mounting: Mount plaques by inserting threaded studs into tapped lugs on back of plaque. Set in predrilled holes filled with quick-setting cement.

3.04 CLEANING AND PROTECTION

A. After installation, clean soiled sign surfaces according to manufacturer's written instructions. Protect signs from damage until acceptance by the Engineer.

END OF SECTION

SECTION 10280

TOILET ACCESSORIES

PART 1 - GENERAL

1.01 GENERAL PROVISIONS

A. 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.

1.02 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Toilet accessories as scheduled on the Drawings.

B. Related Work: The following items are not included in this Section and are specified under the designated Sections:

1. Section 06100 - ROUGH CARPENTRY for blocking.

1.03 SUBMITTALS

A. Product Data: For each type of product indicated. Include the following:

1. Construction details and dimensions.
2. Anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
3. Material and finish descriptions.
4. Features that will be included for Project.
5. Manufacturer's warranty.

B. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.

1. Identify locations using room designations indicated on Drawings.
2. Identify products using designations indicated on Drawings.

C. Maintenance Data: For toilet accessories to include in maintenance manuals.

1.04 QUALITY ASSURANCE

A. Source Limitations: For products listed together in the same articles in Part 2, provide products of same manufacturer unless otherwise approved by Engineer.

1.05 COORDINATION

A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.

B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

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

1. A & J Washroom Accessories, Inc.
2. American Specialties, Inc.
3. Bobrick Washroom Equipment, Inc.
4. Bradley Corporation.
5. General Accessory Manufacturing Co. (GAMCO).

2.02 MATERIALS

A. Stainless Steel: ASTM A 666, Type 304, 0.0312-inch minimum nominal thickness, unless otherwise indicated.

B. Steel Sheet: ASTM A 1008/A 1008M, Designation CS (cold rolled, commercial steel), 0.0359-inch (0.9-mm) minimum nominal thickness.

C. Galvanized Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.

D. Fasteners: Screws, bolts, and other devices of same material as accessory unit and tamper-and-theft resistant where exposed, and of galvanized steel where concealed.

2.03 FABRICATION

A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.

B. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to the Owner.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.

B. Grab Bars: Install to withstand a downward load of at least 250 lbf, when tested according to method in ASTM F 446.

3.02 ADJUSTING AND CLEANING

A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.

B. Remove temporary labels and protective coatings.

C. Clean and polish exposed surfaces according to manufacturer's written recommendations.

END OF SECTION

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SECTION 10440

FIRE-PROTECTION SPECIALTIES

PART 1 - GENERAL

1.01 GENERAL PROVISIONS

A. 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.

1.02 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Portable fire extinguishers.
2. Mounting brackets for fire extinguishers.

B. Related Work: The following items are not included in this Section and are specified under the designated Sections:

1. Division 15 - FIRE PROTECTION for fire hose valves and standpipes.

1.03 SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each item.

1. Fire Extinguishers: Include rating and classification.

B. Maintenance Data: For fire extinguishers to include in maintenance manuals.

1.04 QUALITY ASSURANCE

A. Source Limitations: Obtain fire extinguishers through one source from a single manufacturer.

B. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."

C. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

PART 2 - PRODUCTS

2.01 PORTABLE FIRE EXTINGUISHERS

A. General: Provide fire extinguishers of type, size, and capacity for each fire-protection cabinet and mounting bracket indicated.

B. Multipurpose Dry-Chemical Type in Steel Container: UL-rated 2-A:10-B:C, 5-lb nominal capacity, with monoammonium phosphate-based dry chemical in enameled-steel container.

2.02 MOUNTING BRACKETS

A. Mounting Brackets: Manufacturer's standard steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.

B. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Engineer.

2.03 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Finish fire-protection cabinets after assembly.

D. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine walls and partitions for suitable framing depth and blocking where extinguishers will be installed.

B. Examine fire extinguishers for proper charging and tagging. Contractor shall be responsible for fire extinguisher tagging by a certified service technician located within 75 miles of the project.

1. Remove and replace damaged, defective, or undercharged units.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. General: Install fire-protection specialties in locations and at mounting heights indicated on the Drawings and acceptable to authorities having jurisdiction.

B. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

C. Identification: Apply vinyl lettering at locations indicated.

3.03 ADJUSTING AND CLEANING

A. Remove temporary protective coverings and strippable films, if any, as fire-protection specialties are installed, unless otherwise indicated in manufacturer's written installation instructions.

B. Touch up marred finishes or replace fire-protection specialties that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by fire-protection specialty manufacturer.

END OF SECTION

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DIVISION 11

SECTION 11215

HORIZONTAL SPLIT CASE CENTRIFUGAL PUMPS

PART 1 - GENERAL

1.01 DESCRIPTION

A. The Contractor shall furnish materials, equipment and labor to furnish, install and test the pumping system complete with the pumps, motors, mounting bases, piping, valves and appurtenances, as indicated on the contract drawings and as herein specified.

1.02 INSTALLATION

A. The Contractor shall insure that the pumps and motors are properly installed with no pipe strain transmitted to the pump casing.

1.03 RESPONSIBILITY

A. To assure a properly integrated and compatible system, all equipment described in this section shall be furnished by the Pump Manufacturer, who shall assume full responsibility for the proper operation of the pumps and associated equipment.

1.04 SUPERVISION

A. The Contractor shall arrange for the Pump Manufacturer to provide a factory-trained representative as required for the purpose of supervising installation, start-up, final field acceptance testing, and providing instruction to the owner's operating personnel in the proper operation and maintenance of the equipment in this section.

1.05 REFERENCE STANDARDS

A. The work in this section is subject to the requirements of applicable portions of the following standards:

1. Hydraulic Institute Standards
2. IEEE Standards
3. NEMA Standards
4. OSHA Rules and Regulations

PART 2 - PRODUCTS

2.01 GENERAL DESCRIPTION

A. The pumps shall be a single-stage centrifugal split case pump, Pentair-Aurora Model 410, Peerless, Flowserve, or pre-approved equal. Pre-approval must be obtained a minimum of ten days before bid date.

2.02 MATERIALS OF CONSTRUCTION

Casing	Cast Iron (ASTM A48)
Impeller	Bronze (ASTM B62)
Shaft	416 Stainless Steel
Shaft Sleeve	316 Stainless Steel
Case Wear Ring	Bronze (ASTM B62)

2.03 CASING

B. The casing will be of the horizontal split case design. The casing shall have tapped and plugged holes for priming, vent and drain. Removal of the upper half of the casing must allow removal of the rotating element without disconnecting the suction or discharge piping. The lower half of the casing shall be furnished with cored passageways from the high pressure area of the volute to each seal box for positive lubrication without the use of external flushing lines. The bearing arms shall be cast integrally with the lower half of the casing to assure positive bearing alignment. In no case will bolt on bearing arms be acceptable. Each bearing arm will provide a reservoir area for accumulation of weepage from the stuffing box, and a drilled and tapped opening will be provided at the lower portion to allow piping by the Contractor to the nearest floor drain.

2.04 IMPELLERS

A. The impeller shall be designed to give the characteristics outlined under "Performance". It shall be of the enclosed type, cast in one piece. It shall be furnished all over, the exterior being turned and the interior being furnished smooth and cleaned of all burrs, trimmings and irregularities. The impeller will be dynamically balanced. It shall be held securely to the shaft by a key of ample size and shall be locked in place by threaded shaft sleeves.

2.05 SHAFT SLEEVES

A. The shaft sleeves shall be extended from the hub of the impeller, through the seal box area, and beyond the gland. They shall be sealed at the impeller hub by a Buna O-ring to prevent pumped liquid from contacting the shaft. They shall be threaded to hold them securely in place, and designed so as to lock the impeller.

2.06 CASE WEARING RINGS

A. The pump casing shall be fitted with case wear rings to minimize abrasive and corrosive wear to the casing. The wear rings shall be of the radial type, shall have a shoulder machined around the circumference to match a machined shoulder in the casing to provide two sealing faces and to locate the rings in the casing. The rings shall be securely located from rotation by means of pins to the lower casing half.

2.07 MECHANICAL SEALS

A. Mechanical seal boxes shall be placed on both sides of the pump centerline to seal the pump shaft. The mechanical seal boxes shall be equipped with heavy, cast, on piece, “O” ring seal glands.

B. Each pump is to be furnished with mechanical seals with all wetted parts to be 303 stainless steel with “Buna-N” elastomers, Ni-Resist seat, and carbon washer.

A. A bypass shall be provided for the upper seal between the seal faces and the discharge flange to assure adequate venting of the seal chamber and to provide lubrication. Pump shall be provided with a cored passage in the parting flange of the pump to provide additional circulation to the first stage seal.

2.08 SHAFT

A. The pump shaft shall be one-piece, finished and polished on all sections. The shaft shall be of ample strength and rigidity and the shortest practicable distance between bearings shall be used to keep deflection and vibration to a minimum. The maximum allowable deflection of the shaft is 0.002" at any point of operation on the pump curve.

2.11 BEARINGS

A. The pump shall be supplied with a single row inboard bearing primarily for radial loads and a double row outboard bearing primarily for thrust loads. Both bearings shall be regreaseable lubrication ball type, designed for 250,000 hours average life. Each bearing shall be mounted in a machined housing that is moisture and dust proof. The housing shall have registered fits to assure alignment, pinned to prevent rotation, and bolted to the bearing arms. Each housing shall be supplied with a grease fitting and a plugged relief port.

2.12 COUPLING

A. A flexible coupling shall be provided to connect the pump shaft to the motor shaft. The coupling shall be of an all metal type with a flexible rubber insert. The entire rotating coupling element shall be enclosed by a coupling guard.

2.13 BASEPLATE

A. The pump and motor shall be mounted on a groutable steel baseplate or steel driprim baseplate with integral drip channels incorporated on each side. Each channel shall include an NPT connection and plug. The base shall be sufficiently rigid to support the pump and motor without the use of additional supports or members.

2.14 MOTOR

A. The motor shall be horizontal and in accordance with the latest NEMA standards, and shall have the following characteristics:

Enclosure	TEFC
Number of Phases	Three
Cycles	60 Hz
Voltages	230/460 Volt
Speed	1180 RPM
Horsepower	100 hp

B. Each motor shall have a sufficient horsepower rating to operate the pump at any point on the pump's head-capacity curve without overloading the nameplate horsepower rating of the motor, regardless of service factor. The motor shall have a service factor of at least 1.15. The service factor is reserved for variations in voltage and frequency.

PART 3 – EXECUTION

3.01 CONDITIONS OF SERVICE

A. Each pump shall be capable of providing the following operating conditions:

Number of Units	3
Type of Drive	Variable Frequency Drive
Discharge Size	8 in
Suction Size	10 in
Design Capacity	2,200 US gpm
Design Head	115 ft
Min. Efficiency at Design	87%
Rotative Speed	1180 RPM
Shut-off Head	142 ft
Drive Horsepower	100 hp
NPSHR at Design	11 ft

3.02 INSPECTION AND FACTORY TESTS

A. Each centrifugal pump furnished under these specifications shall be tested at the factory to verify individual performance. Certified copies of all test reports shall be submitted to the Engineer for approval prior to shipment. Each unit shall be hydrostatically tested in accordance with the Hydraulic Institute Standards.

3.03 INSTALLATION AND ACCEPTANCE TESTS

A. The pumping units shall be installed in accordance with the instructions of the manufacturer and as shown on the drawings by the Contractor.

B. Installation shall include furnishing the required oil and grease for initial operation. The grades of oil and grease shall be in accordance with the manufacturer's recommendations.

3.04 DISINFECTING AND FLUSHING

A. The Contractor shall disinfect the lines and equipment carrying potable water.

B. Furnish all equipment and materials necessary to do the work of disinfecting, and shall perform the work in accordance with the procedure outlined in the AWWA Standard C651 except as otherwise specified herein.

C. During the disinfection period, care shall be exercised to prevent contamination of water in existing mains.

D. The dosage shall be such as to produce a chlorine concentration of 25 mg/L. The chlorine concentration shall not less than 10 PPM (mg/l) after a contact time of not less than 24 hours. Chlorinated water shall not remain in the water system being treated for greater than a period of 24 hours.

E. After treatment, the main shall be flushed with clean water until the residual free chlorine content does not exceed 0.2 PPM (mg/l).

F. Before disposing of the water used in disinfecting and flushing water mains and equipment, thoroughly neutralize it through the application of a reducing agent, as referenced in AWWA C651.

G. Dispose of the water used in disinfecting and flushing in an approved manner.

H. Connection at cut-ins shall be swabbed with 50-PPM solution of chlorine at locations when other methods are not applicable.

3.05 SAMPLING

A. Bacteriological sampling and testing shall be done in accordance with AWWA C651 for each main and each branch. Sampling shall be accomplished with sterile bottles treated with sodium thiosulfate, as required by Standard Methods. No hose or fire hydrants shall be used in collection of samples. A corporation stop installed on the main, with a removable copper tube gooseneck assembly, is the recommended method.

B. Testing shall be done by a laboratory approved by the Engineer, in accordance with Standard Methods, and shall show the absence of coliform organisms. A standard plate count may be required at the option of the Engineer.

C. After final flushing of the new pipes and equipment and before the pump station is connected to the distribution system, two consecutive sets of samples taken 24 hours apart shall be taken.

D. Collection of samples shall be performed by a qualified third party and shall be analyzed by a Massachusetts certified lab.

E. All samples shall be taken in accordance with the most recent edition of Standard Methods for the Examination of Water and Wastewater.

F. Laboratory test results shall demonstrate that all samples have a total coliform count of zero, a residual free chlorine content does not exceed 0.2 PPM (mg/l), and a heterotrophic plate count (HPC) of less than 100 per ml above the HPC of the existing system. In no case shall the total HPC exceed 500 per ml.

G. The cost for chlorination, flushing, sampling and analysis shall be paid for by the Contractor.

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SECTION 11310

APPLIANCES

PART 1 - GENERAL

1.01 GENERAL PROVISIONS

A. 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.

1.02 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Appliances.

B. Related Work: The following items are not included in this Section and are specified under the designated Sections:

1. Division 15 - PLUMBING for water distribution piping connections, drainage and vent piping connections, sinks, and waste disposers.
2. Division 16 - ELECTRICAL for services and connections to appliances.

1.03 SUBMITTALS

A. Product Data: For each type of product indicated. Include operating characteristics, dimensions of individual appliances, and finishes for each appliance.

B. Appliance Schedule: For appliances; use same designations indicated on Drawings.

C. Maintenance Data: For each product to include in maintenance manuals.

D. Warranties: Special warranties specified in this Section.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer for installation and maintenance of units required for this Project.

B. Source Limitations: Provide products from same manufacturer for each type of appliance required.

C. Regulatory Requirements: Comply with provisions of the following product certifications:

1. NFPA: Provide electrical appliances listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
2. UL and NEMA: Provide electrical components required as part of residential appliances that are listed and labeled by UL and that comply with applicable NEMA standards.
3. ANSI: Provide gas-burning appliances that comply with ANSI Z21 Series standards.

D. Regulatory Requirements, Accessibility: Where residential appliances are indicated to comply with accessibility requirements, comply with Massachusetts Architectural Access Board requirements and the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)."

E. Energy Ratings: Provide residential appliances that carry labels indicating energy-cost analysis (estimated annual operating costs) and efficiency information as required by the FTC Appliance Labeling Rule.

1. Provide appliances that qualify for the EPA/DOE ENERGY STAR product labeling program.

F. Switches: Provide mercury-free switches in appliances.

1.05 WARRANTY

A. Special Warranties: Manufacturer's standard form in which manufacturer of each appliance specified agrees to repair or replace residential appliances or components that fail in materials or workmanship within manufacturer's standard warranty period.

PART 2 - PRODUCTS

2.01 APPLIANCES

A. Appliance Schedule: Stainless steel exterior panels; GE, Frigidaire, True or equal; models as selected by Architect.

1. Undercounter refrigerator.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.

B. Examine roughing-in for piping systems to verify actual locations of piping connections before equipment installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION, GENERAL

A. General: Comply with manufacturer's written instructions.

B. Built-in Equipment: Securely anchor units to supporting cabinets or countertops with concealed fasteners. Verify that clearances are adequate for proper functioning and rough openings are completely concealed.

C. Freestanding Equipment: Place units in final locations after finishes have been completed in each area. Verify that clearances are adequate to properly operate equipment.

D. Utilities: Refer to Division 15 - PLUMBING for plumbing requirements and Division 16 - ELECTRICAL for electrical requirements.

3.03 CLEANING AND PROTECTION

A. Test each item to verify proper operation. Make necessary adjustments.

B. Verify that accessories required have been furnished and installed.

C. Remove packing material from appliances and leave units in clean condition, ready for operation.

3.04 DEMONSTRATION

A. Engage a factory-authorized service representative to train the Owner’s maintenance personnel to adjust, operate, and maintain appliances.

END OF SECTION

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SECTION 11280

MAINTAINING EXISTING FLOW

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes

1. Requirements to maintain existing flow and implement and complete all flow diversions and/or bypass pumping required to complete the Work indicated on the Drawings.

B. Related Sections

1. Section 01300 – Submittals
2. Section 01525 – Temporary Enclosures
3. Section 02704 – Pipeline Pressure and Leakage
4. Section 02675 – Disinfection of Water Mains
5. Section 15100 – Valves, Gates and Appurtenances

1.02 PERFORMANCE REQUIREMENTS

A. The existing Edgell Road Water Pumping Station pumps water from the Metro West Tunnel, owned by the MWRA, to the "City Pressure Zone". The water supplied from the Metro West Tunnel has a chloramine residual of approximately 2.0 mg/l.

B. It is essential to the operation of the existing water system that there be no interruption of the distribution system water flow and pressure throughout the duration of this project. An interruption shall be considered, but may not be limited to, any condition that in the sole opinion of the Engineer adversely affects or alters operation of the existing water distribution system including the associated flows;

C. The Contractor shall supply, install and, maintain, temporary facilities such as pumping equipment (both primary and backup units as required) and all other labor, equipment, and fuel to maintain the adequate water levels in the storage tanks. The City of Framingham will operate the pumping system once it is approved for connection to the water system. The Contractor shall provide all fuel and maintenance while the City operates the system.

D. The Contractor's attention is directed to the fact that the existing water demand varies seasonally. Increases in normal flow should be expected during dry periods and summer months.

E. In case of damage caused by the failure of the Contractor to take adequate precautions, the Contractor shall repair or replace equipment damaged and shall make such repairs or rebuild such parts of the damaged work, as the Owner may require, at no additional expense to the Owner.

F. The bypass system shall be equipped with an alarm notification system. The Contractor shall be required to respond within one hour to any bypass system alarm or emergencies 24-hours a day, 7 days a week, 365 days a year.

G. The Contractor shall provide a system capable of bypassing an average of 2,310,000 gallons per day (gpd).

H. The incoming pressure of the water supplied from the MWRA Metro West Tunnel varies from approximately 29 to 32 psi.

I. The pressure required in the distribution system at the station varies from 70 to 76 psi.

J. The City will provide a temporary SCADA control system that will provide START and STOP signals to the temporary bypass system pump controls. The Contractor is responsible for integrating the Start and Stop Signals into the temporary bypass pump controls to provide automatic operation of the temporary bypass pumping system. The bypass system shall incorporate a flow meter, specified herein, that will provide separate analog signals to the City's SCADA and MWRA's Telog systems. The Contractor's bypass system supplier will be required to coordinate with the City's Instrumentation and Control representative.

K. The Contractor will be responsible for:

1. Installing temporary wiring from the existing SCADA/RTU to the bypass system pump control panels. The temporary wiring will be terminated within the existing SCADA/RTU by the City's Instrumentation and Control Integrator. This will facilitate testing of automatic operation of the temporary bypass system prior to relocating the SCADA/RTU.
2. Relocating and installing the existing SCADA/RTU control panel and antenna from the Edgell Road Pump Station to the temporary bypass system following testing.
3. Providing temporary power to the City and MWRA's separate Telog panel.

1.03 SUBMITTALS

A. In accordance with SECTION 01300 submit the following:

1. Detailed plans and descriptions outlining all provisions and precautions to be taken regarding the control and handling of existing flows.

2. Include such items as schedules, locations, elevations, capacities of equipment, materials, and all other incidental items necessary and/or required by the Owner to ensure proper protection of the facilities and compliance with the requirements herein specified.
3. Qualifications as described herein.
4. Detailed proposal for noise prevention measures for review.
5. Shop drawings for all pumping, piping, and appurtenances for type and size of equipment required to perform the flow diversion and/or bypass pumping work as required herein.

1.04 QUALITY ASSURANCE

A. Qualifications

1. The design, installation, operation and weather protection of the temporary pumping system shall be the Contractor's responsibility. The Contractor shall employ the services of a vendor who can demonstrate to the Engineer that he specializes in the design and operation of temporary bypass pumping systems. The vendor shall provide at least five (5) references of projects of similar size and complexity in water applications performed by his firm within the past three years within New England. The bypass system shall meet the requirements of codes and regulatory agencies having jurisdiction.
2. The vendor shall demonstrate the bypass pumping equipment is automated and is capable of functioning without the assistance of an operator.
3. The vendor shall demonstrate the pumping equipment can operate for an extended period of time running intermittently as required to fill the water storage tanks based on on/off level setpoints.
4. The vendor shall demonstrate sufficient service resources and repair parts in stock to fulfill service or repair of rental equipment within one hour of a service call, twenty-four hours per day, seven days per week.
5. Temporary components of the bypass system including pumps, pipe, hose, valves, and fittings shall be provided by one bypass vendor.
6. **Hydraulic calculations and drawings required by the submittals shall be provided by the bypass vendor and stamped and certified by a Professional Engineer licensed in the State of Massachusetts**.

B. Pre-Installation Meeting

1. Contractor to schedule and attend a pre-installation meeting with the vendor, Owner and Engineer prior to installation of by-pass system.

1.05 SPECIAL BYPASS REQUIREMENTS

A. Flow Metering

1. The quantity of water conveyed by the temporary bypass system shall be accurately and continuously measured by a magnetic flow meter. The contractor will be required to provide an analog flow signal (4-20mA) to the City/MWRA.
2. The flowmeter shall be a MagMaster, manufactured by ABB, or approved equal.
3. The Contractor and bypass system supplier will be required to coordinate with the City's Instrumentation and Control representative.
4. The pumping system piping shall be designed and installed to provide the flowmeter's manufacturers recommended up and downstream straight piping requirements.

B. Disinfection and Flushing Requirements

1. All pumps, pipes, fittings, hoses, connections, valves and any other component that will be contact the potable water shall be suitable for potable water service and shall be disinfected prior to use.
2. Furnish all equipment and materials necessary to do the work of disinfecting. Disinfecting shall be performed in accordance with the procedure outlined in the AWWA Standard C651, except as otherwise specified herein.
3. In accordance with Specification Section 02675 – Disinfection of Water Mains

C. Testing

1. The bypass system shall operate successfully, with controlled Start/Stop and flow metering for a minimum of three (3) days prior to Acceptance.
2. In accordance with Specification Section 02704 – Pipeline Pressure and Leakage Testing

D. Sampling

1. In accordance with Specification Section 02675 – Disinfection of Water Mains

E. Weather Protection

1. The bypass system, including pumps, valves and piping shall include provisions for weather protection, including cold weather. Protection shall include temporary enclosures, heat tracing and insulation, as required.

F. Containment

1. A temporary containment system shall be installed under the bypass pumps and fuel storage tanks to adequately contain spills and leaks of fuel, lubricants and cooling fluids.

G. Taps

1. Provide suction and discharge sample taps on temporary piping as directed by the Owner/Engineer. The sample tap provided shall be in accordance with Specification Section 15100.
2. Provide one emergency chlorination tap on the temporary suction piping in accordance with detail shown on sheet MD-1.

H. Emergency Fuel Storage

1. Provide emergency fuel storage for the volume required to run the by-pass pump at demand load for a period of 24-hours.

PART 2 PRODUCTS

2.01 GENERAL

A. At a minimum, all equipment shall be supplied in duplicate for emergency situations. Provide adequate on-line backup facilities so that no interruption in service is encountered. Equipment and installation are subject to the approval of the Owner and the Engineer.

2.02 PUMPING SYSTEM(S)

A. All pumping units (primary and secondary) and appurtenances shall be sized properly to handle the flows encountered.

B. The pumps shall be diesel powered. Onsite fuel storage and piping must incorporate secondary containment and be in accordance with all local, state and federal requirements.

C. Pumps shall be centrifugal, end suction, fully automatic self-priming pumps that do not require the use of foot-valves, vacuum pumps, diaphragm pumps, or isolation valves in the priming system. The pump system must be constructed to pump intermittently as required based on on/off level setpoints in the water storage tanks. All pumping units and appurtenances shall be sized in accordance with the design parameters provided.

D. Seals shall be high pressure, mechanical self-adjusting type with silicon carbide faces capable of withstanding suction pressures to 100 psi running. The mechanical seal shall be cooled and lubricated in an oil bath reservoir, requiring no maintenance or adjustment. Pump shall be capable of running dry, with no damage, for extended periods of time. All metal parts shall be of stainless steel. Elastomers shall be Viton.

E. The Contractor shall provide the necessary start/stop controls for each pump.

F. The Contractor shall be responsible to meet noise requirements specified elsewhere in this section. All diesel driven primary and standby pumps shall be sound attenuated. The use of Critical Silenced Canopy pumps or acoustical Whisper Pac enclosures for sound attenuation are required.

2.03 PIPING SYSTEM(S)

A. All piping systems (primary and secondary) and appurtenance shall be sized properly to handle the flows encountered including increased flows due to wet weather.

B. Provide temporary bypass suction piping from the upstream manhole(s) to the bypass pumps, and temporary discharge piping from the bypass pumps to the downstream discharge manhole(s).

C. The piping system piping shall be designed and installed to provide the flowmeter's manufacturers recommended up and downstream straight piping requirements.

D. A surge relief valve shall be incorporated into the temporary piping system. Refer to specification section 15100 for requirements.

2.04 NOISE PREVENTION

A. Noise prevention measures for all equipment shall be used to insure minimum noise impact or surrounding areas.

B. Measures may include but shall not be limited to enclosures, insulation, electric pumping units, and hospital grade silencers or mufflers.

C. Noise levels shall be maintained such that increase shall not exceed 10 dBA over background at the nearest property line.

D. Should at any time prior to or during the performance of above mentioned work, the Engineer determines the noise prevention measures being used are not adequate, the Contractor shall at no additional cost to the Owner suspend all work until acceptable measures are incorporated.

PART 3 EXECUTION

3.01 PUBLIC SAFETY AND CONVENIENCE

A. General

1. The Contractor shall at all times keep the streets, highways, roads, driveways, parking lots, private walks, and public sidewalks open for pedestrian and vehicular traffic unless otherwise authorized by the Owner/Engineer.

B. Public Travel Ways

1. Any authorized temporary closure of any streets, highways or roads shall be coordinated with the local Fire, Police and/or Department of Public Works as required by the municipality.

3.02 INSTALLATION

A. Keep the Engineer advised at all times of any changes made to the overall operation(s) to accommodate field conditions.

B. Flow diversions and/or bypass pumping shall be maintained at all times as long as it is necessary to maintain the flow through the limits of the project during construction.

C. Maintain auxiliary and/or emergency equipment at the site to continue by-pass pumping operations in the event of a breakdown and/or loss of normal power.

D. The Contractor shall be responsible for the proper functioning and operation of the backup pumping units. Back-up pump(s) shall be on-line, isolated from the primary system by a valve.

E. No work shall begin until all provisions and requirements of this Section have been reviewed and approved by the Engineer.

F. The Engineer reserves the right to limit and/or otherwise restrict the Contractor's overall activities and/or operations at any time without claim should the Engineer deem it to be in the Owner's or public's best interest to do so.

END OF SECTION

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SECTION 11311

SEWAGE GRINDER PUMP STATION

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes

1. Requirements for furnishing complete factory-built and tested Grinder Pump Stations, each consisting of a grinder pump mounted in a pre-cast concrete structure with NEMA 6P electrical quick disconnect, pump removal system, stainless steel discharge assembly/shut-off valve, anti-siphon valve/check valve, each assembled in the basin, electrical alarm panel and all necessary internal wiring and controls, complete with all connections made, tested and ready for use.
2. This specification is based on a model DH071 grinder pump station by Environment One Corporation. Alternatives must indicate substantial compliance with all portions of this specification, and clearly indicate any deviations.

B. Related Sections

1. Section 01300 – Submittals
2. Section 02200 – Earth Excavation, Backfill, Fill and Grading
3. Section 02607 – Precast Concrete Manholes

1.02 SYSTEM DESCRIPTION

A. Performance Requirements

1. The pumping stations shall be designed for the continuous conveyance of raw, unscreened, domestic sanitary sewage through automatic operation, for extended periods of time.
2. The pumps shall be capable of delivering 15 GPM at a total dynamic head of 0 feet (0 PSIG), 11 GPM at a total dynamic head of 92 feet (40 PSIG), and 7.8 GPM at a total dynamic head of 185 feet (80 PSIG). The pump(s) must also be capable of operating at negative total dynamic head without overloading the motor(s). In-line piping or valving shall not be allowed to create a false apparent head.
3. Control of pumps shall be automatic, using an instrumentation and control (I&C) system, which is activated by change in wet well level. All equipment for the pump station shall operate automatically with provision for manual override.

B. Electrical Power Service Requirements

1. Pump motors shall be a 1 HP, 1725 RPM, 240 Volt 60 Hertz, 1 Phase, capacitor start, ball bearing, air-cooled induction type with Class F installation, low starting current not to exceed 30 amperes and high starting torque of 8.4 foot pounds. The motor shall be press-fit into the casting. Pump motor shall be provided with an automatic-reset, integral thermal overload protector. The wet portion of the motor armature shall be 300 Series stainless.

1.03 SUBMITTALS

A. Submit in accordance with SECTION 01300.

B. Product Data

1. Manufacturer's literature on all equipment including descriptions, diagrams, dimensions, materials, specifications, pump characteristic curves, and drawings indicating compliance with the Contract Documents.
2. Detailed installation and user instructions, evidence of an established service program including complete parts and service manuals.
3. Reference and contact list from ten grinder pump installations of the type of grinder pumps described within this specification.
4. Certified pump test data.
5. Motor data such as HP, Volts, RPM, FLC, Efficiency, and power factor.
6. Complete parts list for equipment furnished, including recommended spare parts.

C. Shop Drawings

1. Detailed drawings showing dimensions and materials of construction of pumps, motors, controls, pipes, valves and fittings, equipment, conduit, wiring, wiring devices, access hatches and manhole covers, lifting devices, rails and brackets.
2. Plans, sections and elevations showing a complete layout to scale of all equipment, piping, electrical conduits and wall sleeve installation locations, methods to provide watertight seals, and anchor bolt installation locations.

D. Operation and Maintenance Manuals

1.04 QUALITY ASSURANCE

A. Regulatory Requirements

1. Codes and Standards
   a. UL and NEMA Compliance: Provide electric motors and electrical components required as part of pumping station, which have been listed and labeled by Underwriters Laboratories and comply with NEMA standards.
   b. NEC Compliance: Comply with NFPA 70 "National Electrical Code" as applicable to installation and electrical connections of ancillary electrical components of packaged pump stations.

c. Hazardous Areas: All installations, equipment, materials, devices and incidentals used in the wetwell shall be in accordance with National Electrical Code requirements for Class 1, Division 2 Group D Hazardous Locations.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. The grinder pump stations and all appurtenances shall be manufactured by Environment One Corporation, or approved equal.

2.02 PUMPS AND GRINDERS

A. The grinder pump station shall have a cartridge type core assembly consisting of pump, motor, grinder, motor controls, check valve, anti-siphon valve, level controls, electrical quick disconnect and wiring. The core unit shall be installed in the basin by the manufacturer. Field assembly of the pump and controls into the basin is not acceptable. The watertight integrity of each core unit shall be established by a 100 percent factory test at a minimum of 5 PSIG

B. The pump shall be a vertical rotor, motor driven, solids handling pump of the progressing cavity type with a single mechanical seal. Double radial O-ring seals are required at all casting joints. All pump castings shall be cast iron and fully epoxy coated. The rotor shall be hardened stainless steel. The stator shall be of a ethylene propylene synthetic elastomer, suitable for domestic wastewater service.

C. The grinder shall be placed immediately below the pumping elements and shall be direct-driven by a single, one-piece motor shaft. The grinder impeller (cutter wheel) assembly shall be securely fastened to the pump motor shaft by means of a threaded connection attaching the grinder impeller to the motor shaft. Attachment by means of pins or keys will not be acceptable. The grinder impeller shall be a one-piece, 4140 cutter wheel of the rotating type with inductively hardened cutter teeth. The cutter teeth shall be inductively hardened to Rockwell 50 – 60c for abrasion resistance. The shredder ring shall be of the stationary type and the material shall be white cast iron.

D. Grinder assembly shall be dynamically balanced and operate without objectionable noise or vibration over the entire range of recommended operating pressures. The grinder shall be constructed so as to minimize clogging and jamming under all normal operating conditions including starting. Sufficient vortex action shall be created to scour the tank free of deposits or sludge banks which would impair the operation of the pump. The grinder shall be capable of reducing all components in normal domestic sewage, including a reasonable amount of “foreign objects,” such as paper, wood, plastic, glass, wipes, rubber and the like, to finely-divided particles which will pass freely through the passages of the pump and the 1-1/4" diameter stainless steel discharge piping.

2.03 VALVES

A. The pump discharge within the structure shall be equipped with a "normally open" solenoid valve. The solenoid valve shall be rated for Class 1, Division 2 Group D atmosphere and be energized by the pump's starting contactor to close during pump operation. The intent of the solenoid is to drain the low pressure force main following pump operation.

B. The pump discharge shall be equipped with a factory installed, gravity operated, flapper-type integral check valve built into the stainless steel discharge piping. The check valve will provide a full-ported passageway when open, and shall introduce a friction loss of less than 6 inches of water at maximum rated flow. Moving parts will be made of a 300 Series stainless steel and fabric reinforced synthetic elastomer to ensure corrosion resistance, dimensional stability, and fatigue strength. A nonmetallic hinge shall be an integral part of the flapper assembly providing a maximum degree of freedom to assure seating even at a very low back-pressure. The valve body shall be an injection molded part made of an engineered thermoplastic resin. The working pressure of the valve shall be at least 235 psi. Ball-type check valves are unacceptable due to their limited sealing capacity in slurry applications.

C. The pump discharge shall be equipped with a factory-installed, gravity-operated, flapper-type integral anti-siphon valve built into the stainless steel discharge piping. Moving parts will be made of 300 Series stainless steel and fabric-reinforced synthetic elastomer to ensure corrosion resistance, dimensional stability, and fatigue strength. A nonmetallic hinge shall be an integral part of the flapper assembly, providing a maximum degree of freedom to ensure proper operation even at a very low pressure. The valve body shall be injection-molded from an engineered thermoplastic resin. Holes or ports in the discharge piping are not acceptable anti-siphon devices due to their tendency to clog from the solids in the slurry being pumped. The anti-siphon port diameter shall be no less than 60% of the inside diameter of the pump discharge piping.

2.04 INSTRUMENTATION AND CONTROL

A. All necessary motor starting controls shall be located in the cast iron enclosure of the core unit secured by stainless steel fasteners. The wastewater level sensing controls shall be housed in a separate enclosure from motor starting controls. The level sensor housing must be sealed via a radial type seal; solvents or glues are not acceptable. The level sensing control housing must be integrally attached to pump assembly so that it may be removed from the station with the pump and in such a way as to minimize the potential for the accumulation of grease and debris accumulation. The level sensing housing must be a high-impact thermoplastic copolymer over-molded with a thermo plastic elastomer. The use of PVC for the level sensing housing is not acceptable.

B. Non-fouling wastewater level controls for controlling pump operation shall be accomplished by monitoring the pressure changes in an integral air column connected to a pressure switch. The air column shall be integrally molded from a thermoplastic

elastomer suitable for use in wastewater and with excellent impact resistance. The air column shall have only a single connection between the water level being monitored and the pressure switch. Any connections are to be sealed radially with redundant O-rings. The level detection device shall have no moving parts in direct contact with the wastewater and shall be integral to the pump core assembly in a single, readily-exchanged unit. Depressing the push to run button must operate the pump even with the level sensor housing removed from the pump.

C. All fasteners throughout the assembly shall be 300 Series stainless steel. High-level sensing will be accomplished by a separate air column sensor and pressure switch. Closure of the high-level sensing device will energize an alarm circuit as well as a redundant pump-on circuit. Pump ON/OFF and high-level alarm functions shall not be controlled by the same switch. Float switches of any kind will not be acceptable. Each core shall be equipped with a factory installed equalizer diaphragm that compensates for any atmospheric pressure or temperature changes. The grinder pump will be furnished with a 6 conductor 14 gauge, type SJOW cable, pre-wired and watertight to meet UL requirements with a factory installed NEMA 6P EQD half attached to it.

D. The grinder pump station shall include a NEMA 4X, UL-listed alarm panel suitable for wall mounting. The enclosure shall be manufactured of thermoplastic polyester to ensure corrosion resistance. The enclosure shall include a hinged, lockable cover with padlock, preventing access to electrical components, and creating a secured safety front to allow access only to authorized personnel.

E. The alarm panel shall contain one 15-amp, double-pole circuit breaker for the pump core's power circuit and one 15-amp single-pole circuit breaker for the alarm circuit. The panel shall contain a push-to-run feature, an internal run indicator, and a complete alarm circuit. All circuit boards in the alarm panel are to be protected with a conformal coating on both sides and the AC power circuit shall include an auto resetting fuse.

F. The alarm panel shall include the following features: external audible and visual alarm; push-to-run switch; push-to-silence switch; redundant pump start; and high level alarm capability. The alarm sequence is to be as follows when the pump and alarm breakers are on:

1. When liquid level in the sewage wet-well rises above the alarm level, audible and visual alarms are activated, the contacts on the alarm pressure switch activate, and the redundant pump starting system is energized.
2. The audible alarm may be silenced by means of the externally mounted, push-to-silence button.
3. Visual alarm remains illuminated until the sewage level in the wet-well drops below the "off" setting of the alarm pressure switch.

G. The entire alarm panel, as manufactured shall be listed by Underwriters Laboratories, Inc.

PART 3 EXECUTION

3.01 INSTALLATION

A. Excavation and Backfill in accordance with SECTION 02200

B. All pumps and pump controls shall be installed in accordance with the instructions of the manufacturer.

3.02 FIELD QUALITY CONTROL

A. The manufacturer shall provide the services of qualified factory trained technicians who shall inspect the placement and wiring of each station and perform field tests as specified herein.

B. All equipment and materials necessary to perform testing shall be the responsibility of the contractor**.** This includes, as a minimum, a portable generator and power cable (if temporary power is required), water in each basin (filled to a depth sufficient to verify the high level alarm is operating), and opening of all valves in the system. These steps shall be completed prior to the qualified factory trained technician(s) arrival on site.

C. The services of a trained factory-authorized technician shall be provided for a minimum of 16 hours.

D. Upon completion of the installation, the authorized factory technician(s) will perform the following test on each station:

1. Make certain the discharge shut-off valve in the station is fully open.
2. Turn ON the alarm power circuit and verify the alarm is functioning properly.
3. Turn ON the pump power circuit. Initiate the pump operation to verify automatic "on/off" controls are operative. The pump should immediately turn ON.
4. Consult the Manufacturer's Service Manual for detailed start-up procedures.

E. Upon completion of the start-up and testing, the manufacturer's representative shall submit to the engineer a start-up authorization form describing the results of the tests performed for each grinder pump station. Final acceptance of the system will not occur until authorization forms have been received for each pump station installed and any installation deficiencies corrected.

END OF SECTION

DIVISION 12

SECTION 12240

WINDOW TREATMENTS

PART 1 - GENERAL

1.01 GENERAL PROVISIONS

A. 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.

1.02 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
   a. Roller shades and manual shade operators.

B. Related Work: The following items are not included in this Section and are specified under the designated Sections:

   1. Section 06100 – ROUGH CARPENTRY for wood blocking for mounting roller shades and accessories.

   2. Section 04222 – ARCHITECTURAL UNIT MASONRY for mounting.

1.03 SUBMITTALS

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

B. Shop Drawings: Show location and extent of roller shades. Include elevations, sections, details, and dimensions not shown in Product Data. Show installation details, mountings, attachments to other work, operational clearances, and relationship to adjoining work.

C. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
   1. Shade mounting assembly and attachment to building structure.
   2. Size and location of access to shade operator and adjustable components.
   3. Minimum Drawing Scale: 1/4 inch = 1 foot.

D. Samples for Verification:
   1. Complete, full-size operating unit not less than 16 inches wide for each type of roller shade indicated.

2. For the following products:
    a. Shade Material: Not less than 12-inch- square section of fabric, from dye lot used for the Work, with specified treatments applied. Show complete pattern repeat. Mark top and face of material.
    b. Valance: Full-size unit, not less than 12 inches long.

E. Window Treatment Schedule: For roller shades. Use same designations indicated on Drawings.

F. Product certificates: For each type of roller shade, signed by product manufacturer.

G. Qualification Data: For Installer.

H. Product Test Reports: For each type of roller shade.

I. Maintenance Data: For roller shades to include in maintenance manuals. Include the following:
    1. Methods for maintaining roller shades and finishes.
    2. Precautions about cleaning materials and methods that could be detrimental to fabrics, finishes, and performance.
    3. Operating hardware.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of products

B. Source Limitations: Obtain roller shades through one source from a single manufacturer.

C. Fire-Test-Response Characteristics: Provide roller shade band materials with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
    1. Flame-Resistance Ratings: Passes NFPA 701.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver shades in factory packages, marked with manufacturer and product name, fire-test-response characteristics, and location of installation using same designations indicated on Drawings and in a window treatment schedule.

1.06 PROJECT CONDITIONS

A. Environmental Limitations: Do not install roller shades until construction and wet and dirty finish work in spaces, including painting, is complete and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

B. Field Measurements: Where roller shades are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Allow clearances for operable glazed units' operation hardware throughout the entire operating range. Notify Architect of discrepancies. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1.07 EXTRA MATERIALS

A. Furnish extra materials described below hat match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Rollers Shades: Before installation begins, for each size, color, texture, and pattern indicated, full-size units equal to 5 percent of amount installed.

PART 2 - PRODUCTS

2.01 ROLLER SHADES

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
   1. Lutron.
   2. Phifer Inc.
   3. MechoShade Systems, Inc.
   4. Nysan Shading Systems Ltd.

B. Shade Band Material: PVC-free coated fiberglass
   1. Basis of Design: Phifer; Sheer Weave 8000 Series
   2. Style: Dense Basket Weave.
   3. Colors: S01 Snow.
   4. Material Openness Factor: 3%.
   5. Material UV Blockage: 0.06.
   6. Bottom Hem: Straight, weighted type.

C. Rollers: Electrogalvanized or epoxy primed steel or extruded-aluminum tube of diameter and wall thickness required to support and fit internal components of operating system and the weight and width of shade band material without sagging; designed to be easily removable from support brackets; with removable spline fitting integral channel in tube for attaching shade material.
   1. Direction of Roll: Regular, from back of roller

D. Mounting Brackets: Galvanized or zinc-plated steel.

E. Fascia: L-shaped, formed-steel sheet or extruded aluminum; long edges returned or rolled; continuous panel concealing front and bottom of shade roller, brackets, and operating hardware and operators; length as indicated on Drawings removable design for access.

F. Top/Back Cover: L-shaped; material and finish to match fascia; combining with fascia and end caps to form a six-sided headbox enclosure sized to fit shade roller and operating hardware inside.

G. Pocket-Style Headbox: U-shaped, formed-steel sheet or extruded aluminum; long edges returned or rolled; with a bottom cover consisting of slot opening of minimum dimension to allow lowering and raising of shade and a removable or an openable, continuous metal access panel concealing shade roller, brackets, and operating hardware and operators within.

H. Bottom Bar: Steel or extruded aluminum. Provide concealed, by pocket of shade material, internal-type bottom bar with concealed weight bar as required for smooth, properly balanced shade operation.

I. Mounting: As indicated on Drawings, mounting permitting easy removal and replacement without damaging roller shade or adjacent surfaces and finishes.

J. Hold-Down Brackets and Hooks or Pins: Manufacturer's standard for anchoring roller shade bottom in place and keeping shade band material taut.

2.02 ROLLER SHADE FABRICATION

A. Product Description: Roller shade consisting of a roller, a means of supporting the roller, a flexible sheet or band of material carried by the roller, a means of attaching the material to the roller, a bottom bar, and an operating mechanism that lifts and lowers the shade.

B. Concealed Components: Noncorrodible or corrosion-resistant-coated materials.
   1. Lifting Mechanism: With permanently lubricated moving parts.

C. Unit Sizes: Obtain units fabricated in sizes to fill window and other openings as follows, measured at 74 deg F:
   1. Shade Units Installed between (Inside) Jambs: Edge of shade not more than 1/4 inch from face of jamb. Length equal to head to sill dimension of opening in which each shade is installed.
   2. Shade Units Installed Outside Jambs: Width and length as indicated, with terminations between shades of end-to-end installations at centerlines of mullion or other defined vertical separations between openings.

D. Installation Brackets: Designed for easy removal and reinstallation of shade, for supporting fascia, roller, and operating hardware and for hardware position and shade mounting method indicated.

E. Installation Fasteners: No fewer than two fasteners per bracket, fabricated from metal noncorrosive to shade hardware and adjoining construction; type designed for securing to supporting substrate; and supporting shades and accessories under conditions of normal use.

F. Color-Coated Finish: For metal components exposed to view, apply manufacturer's standard baked finish complying with manufacturer's written instructions for surface preparation including pretreatment, application, baking, and minimum dry film thickness.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances, other conditions affecting performance.
   1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 ROLLER SHADE INSTALLATION

A. Install roller shades level, plumb, and aligned with adjacent units according to manufacturer's written instructions, and located so shade band is not closer than 2 inches to interior face of glass. Allow clearances for window operation hardware.

3.03 ADJUSTING

A. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

3.04 CLEANING AND PROTECTION

A. Clean roller shade surfaces after installation, according to manufacturer's written instructions.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that roller shades are without damage or deterioration at time of Substantial Completion.

C. Replace damaged roller shades that cannot be repaired, in a manner approved by Architect, before time of Substantial Completion.

END OF SECTION

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SECTION 12481

ENTRANCE FLOOR MATS

PART 1 - GENERAL

1.01 GENERAL PROVISIONS

A. 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.

1.02 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Surface mounted walk-off mats.

1.03 SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Verification Samples: For each type of product indicated.

1.04 QUALITY ASSURANCE

A. Accessibility Requirements: Provide installed floor mats that comply with Section 4.5 in the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)" and the Massachusetts Architectural Access Board.

1.05 EXTRA MATERIALS

A. Furnish three additional full-size entrance mats for Owner attic stock..

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Berber RB by Mats Inc. or equal by Balco or Durable Corp.

B. Material: One-piece, 3/8-inch-thick, 100% solution-dyed UV stabilized polypropylene fibers with rubber backing. Color as selected by Engineer from manufacturer's standard colors.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install mats to comply with manufacturer's written instructions. Coordinate top of mat surfaces with bottom of doors that swing across mats to provide clearance between door and mat.

B. Defer installation of floor mats until Project is near Substantial Completion.

END OF SECTION

DIVISION 15

SECTION 15050

PIPE PENETRATIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Requirements for furnishing and installing pipe penetration assemblies. This Section covers materials for various pipe penetration configurations. Refer to the Contract Drawings for details of assembly and for location.

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM)

1. ASTM A53, Standard Specification for Pipe, Steel, Black, and Hot-Dipped, Zinc-Coated, Welded and Seamless.

B. American National Std. Institute (ANSI)/American Water Works Assoc. (AWWA)

1. ANSI/AWWA C151/A21.51, Ductile Iron Pipe, Centrifugally Cast in Metal Molds or Sand Lined Molds for Water or Other Liquids

1.03 SUBMITTALS

A. Submit to in accordance with SECTION 01300, manufacturers' literature on all items to be furnished, installation instructions, and where applicable, fire rating and certified test results of the various components.

PART 2 PRODUCTS

2.01 PIPE SLEEVES

A. Unless otherwise shown all pipe sleeves shall be Schedule 40 galvanized steel pipe conforming to ASTM A53. Provide a 2-in minimum circumferential water stop welded to exterior of sleeve at its midpoint. Ends of sleeves shall be cut, ground smooth, and shall be flush with the wall or ceiling and extend 2-in above finished floors. Sleeves required to be sealed by caulking shall be sized as required. Sleeves required to be sealed with mechanical seals shall be sized in accordance with the seal manufacturer's recommendations, and shall be a single seal for wall thicknesses up to and including 12-in; two mechanical seals shall be provided for wall thicknesses greater than 12-in. Sleeves for insulated piping shall be sized to accommodate the approved insulation.

2.02 WALL CASTINGS

A. Unless otherwise shown, wall castings shall be ductile iron conforming to ANSI/AWWA C151/A21.51, thickness Class 53, diameter as required. Flanges and/or mechanical joint bells shall be drilled and tapped for studs where flush with the wall. Castings shall be

provided with an intermediate ½-in thick by 2-in minimum circumferential flange/waterstop, integrally cast with or welded to the casting, located such that it falls within the middle third of the wall.

2.03 SEALING MATERIALS

A. Mechanical seals shall be modular, adjustable, bolted, mechanical type consisting of interlocking synthetic rubber links shaped to continuously fill the annular space between the pipe and sleeve. The seal shall be rated by the manufacturer for 40 feet of head or 20 psig. Mechanical seals shall be Link-Seal, manufactured by Thunderline Corp., Wayne, MI., or equal.

B. Sealant shall be a two part foamed silicone elastomer as manufactured by Dow Corning Co., product No. 3-6548 silicone R.T.V.; 3M brand fire barrier products caulk C.P. 25 and 3M brand putty 303; or Flame-Safe fire stop systems Fig. No. FS-500 by Thomas & Betts Corporation. Packing shall be a fire retardant pliable material, Fig. 310 by Sealtite Co., White Oakum W.S.-600 by American Manufacturing Co., or equal. Sealant bead configuration, depth and width shall be in accordance with manufacturer's recommendations.

2.04 MISCELLANEOUS MATERIALS

A. Bonding compound shall be Sikadur Hi-Mod epoxy by Sika Corporation, equal by Euclid Chemical Corporation; Master Buildings Company or equal.

B. Non-shrink grout shall be Masterflow 713 by Master Builders Company, Euco N-S by Euclid Chemical Co.; Five Star Grout by U.S. Grout Corp. or equal.

C. Galvanized escutcheon plates shall be provided for all exterior sleeved wall penetrations above finished grade.

PART 3 EXECUTION

3.01 INSTALLATION

A. Assemble and install components of pipe penetration assemblies as detailed in the Contract Documents.

END OF SECTION

SECTION 15070

DUCTILE-IRON PIPE AND FITTINGS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes

1. Requirements to furnish, install, joint, and test ductile-iron pressure pipe, fittings (including special castings), and appurtenant materials and equipment indicated on the Drawings and specified in this Section.
2. This Section covers Ductile-Iron Piping not buried in earth.

B. Related Sections

1. Section 09900 – Painting
2. Section 15140 – Pipe Hangers and Supports

1.02 REFERENCES

A. American National Standards Institute (ANSI)

1. A21.4, Standard for Cement-Mortar Lining for Ductile-Iron and Gray-Iron Pipe and Fittings for Water.
2. A21.10, Standard for Gray-Iron and Ductile-Iron Fittings, 3-inch. through 48-inch., for Water and Other Liquids.
3. A21.11, Standard for Rubber-Gasket Joints for Ductile-Iron and Gray-Iron Pressure Pipe and Fittings.
4. A21.15, Standard for Flanged Cast-Iron and Ductile-Iron Pipe with Threaded Flanges
5. A21.50, Standard for Thickness Design of Ductile-Iron Pipe.
6. A21.51, Standard for Ductile-Iron Pipe, Centrifugally Cast in Metal Molds, or Sand-Lined Molds, for Water or Other Liquids.
7. B16.1, Standard for Ductile Iron Pipe Flanges and Flanged Fittings.

B. American Water Works Association (AWWA)

1. C606, Standard for Grooved and Shouldered Joints.
2. C651, Standard for Disinfecting Water Mains.

C. American Society for Testing Materials (ASTM)

1. A307, Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.

1.03 SUBMITTALS

A. In accordance with SECTION 01300 submit the following:

B. Shop Drawings

1. Piping layouts in full detail.
2. Location of pipe hangers and supports.
3. Location and type of backup block or device to prevent separation.
4. Large scale details of all wall penetrations and special castings.
5. Schedules of all pipe, fittings, special castings, couplings, expansion joints, and other appurtenances.

C. Certificates

1. Sworn certificates in duplicate of shop tests showing compliance with appropriate standard.

D. Manufacturer's Literature

1. Catalog cuts of joints, couplings, harnesses, expansion joints, gaskets, fasteners and other accessories.
2. Brochures and technical data of coatings and lining's and proposed method of application.

1.04 QUALITY ASSURANCE

A. Inspect and test at foundry according to ANSI Standards.

B. Owner reserves right to inspect and/or test by independent service at manufacturer's plant or elsewhere at his own expense.

C. Owner reserves right to perform visual inspection and hammer test before installation.

PART 2 PRODUCTS

2.01 PIPE

A. Ductile-Iron Pipe

1. Designed in accordance with ANS A21.50.

2. Manufactured in accordance with ANS A21.15 or ANS A21.51.

3. Ductile-iron pipe shall be at least thickness **Class 52** for pipe 4-inch. and smaller and at least thickness **Class 53** for pipe 6-inch. and larger, unless stated otherwise.

4. Ductile-iron pipe for use with split couplings shall have a thickness as specified in this Section.

B. Pipe For Use With Couplings

1. Pipe for use with split couplings shall be as specified above except that the ends shall not have bells or beads but shall have cast or machined shoulders or grooves conforming to AWWA C606.

2.02 FITTINGS

A. Flanged Fittings

1. Provide with working pressure of 250 psi.

2. Faced and drilled in accordance with ANS A21.10 except that special drilling or tapping shall be provided as necessary to ensure correct alignment and bolting.

3. Flanged fittings which are not available under ANS A21.10 (e.g. laterals orreducing ells) shall be furnished to conform to the requirements of ANS B16.1, class 125.

B. Base Elbows

1. Fittings shall be provided with standard bases in accordance with ANSI/AWWA C110/A21.10 where so indicated.

C. Grooved Fittings

1. In accordance with ANS A21.10 in all respects except minimum wall thickness as follows:

Nominal Pipe size, in.	Minimum wall thickness, in.
3	0.40
4	0.40
6	0.45
8	0.53
10	0.55
12	0.60

D. Nonstandard Fittings

1. Fittings having nonstandard dimensions and cast especially for this project shall be of acceptable design. They shall be manufactured to meet the requirements of

the same specifications and shall have the same diameter and thickness as standard fittings, but their laying lengths and types of ends shall be determined by their positions in the pipelines and by the particular piping to which they connect.

2.03 ADAPTERS

A. Where it is necessary to joint pipes of different type, furnish and install the necessary adapters unless solid sleeves are indicated on the drawings or permitted. Adapters shall have ends, conforming to the above specifications for the appropriate type of joint, to receive the adjoining pipe. Adapters joining two classes of pipe may be of the lighter class provided that the annular space in bell-and-spigot type joints will be sufficient for proper jointing.

2.04 JOINTS

A. Gaskets

1. Gaskets shall be of a composition suitable for exposure to the product which the pipe is intended.

B. Flanges

1. Flanges for flanged pipe shall conform to ANS A21.15 except that special drilling or tapping shall be done as necessary to ensure correct alignment and bolting.

2.05 COUPLINGS

A. Flexible Connections at Equipment

1. Where flexible connections in the piping are specified or indicated on the Drawings, they shall flanged end, heavy duty rubber body type specifically designed for connecting pipe to pump or similar configuration.

B. Split Couplings

1. Split couplings may be used for connecting ductile-iron pipe. If split couplings are used with grooved pipe, the minimum pipe wall thickness shall be as specified under AWWA C606.
2. Split couplings shall be made of malleable iron and shall be NAPPCO couplings made by North American Pipe Products Co.; or acceptable equivalent products.
3. Where split couplings are furnished in lieu of flanged joints the joint shall be of the rigid type with pipe grooves cut to bring the ends of the pipe solidly together. The beam strength of the joint shall be equal to or greater than that of a flanged joint.
4. Where split couplings are indicated to provide for expansion or flexibility, the pipe grooves shall be cut to provide the necessary expansion or flexibility.

2.06 ACCESSORIES

A. Filling Rings

1. Provide suitable filling rings where the layout of the flanged piping is such as to necessitate their use. In materials, workmanship, facing, and drilling, such rings shall conform to ANSI Class 125 standard.
2. Filling rings shall be of suitable length with nonparallel faces and corresponding drilling, if necessary, to ensure correct assembly of the adjoining piping or equipment.

B. Gaskets, Bolts, And Nuts

1. For flanged joints, gaskets shall be ring gaskets of rubber with cloth insertion. Gaskets 12-inch diameter and smaller shall be 1/16-inch thick; larger than 12-inch, to be 1/8-inch thick.
2. Flanged joints shall be made with bolts, bolt studs with a nut on each end, or studs with nuts where the flange is tapped. The number and size of bolts shall conform to the same American National Standard as the flanges.
3. Bolts and nuts shall, except as otherwise specified or noted on the drawings, be Grade B conforming to ASTM, A307.
4. Bolt studs and studs shall be of the same quality as machine bolts.
5. Submerged flanged joints shall be made up with Type 316 stainless steel stud bolts and nuts.

C. Tapped Connections

1. Tapped connections in pipe and fittings shall be made in such manner as to provide a watertight joint and adequate strength against pullout. The maximum size of taps in pipe or fittings without bosses, shall not exceed the listed size in the appropriate table of the Appendix to the above-mentioned ANS A21.51 based on 3 full threads for cast iron and 2 full threads for ductile iron.
2. Where the size of the connections exceeds that given above for the pipe in question, a boss shall be provided on the pipe barrel, the tap shall be made in the flat part of the intersection of the run and branch of a tee or cross, or the connection shall be made by means of a tapped tee, branch fitting and tapped plug or reducing flange, or tapping tee and tapping valve, all as indicated or permitted by the Engineer.
3. All drilling and tapping of cast-iron pipe shall be done normal to the longitudinal axis of the pipe; fitting shall be drilled and tapped similarly, as appropriate. Drilling and tapping shall be done only by skilled mechanics. Tools shall be adapted to the work and in good condition so as to produce good, clean-cut threads of the correct size, pitch, and taper.

D. Wall Castings

1. Wall castings shall be of the sizes and types indicated on the drawings. Flanges, facing and drilling shall conform to ANS A21.10 except that where required, as where a flange if substantially flush with the face of a masonry wall, flanges shall be drilled and tapped for studs. Other dimensions shall be substantially equal to corresponding parts of standard fittings. A central fin not less than ½-inch. thick and 1-1/2-inch to 2-inch high shall be cast on the barrel at a point that will locate it midway through the wall to form a water stop.

2.07 FINISHES

A. Lining

1. Inside of pipe and fittings shall be coated with double thickness cement lining and bituminous seal coat conforming to AN A21.4. The standard bituminous coating is specified under the appropriate AN Standard for the pipe and fittings.

B. Coating

1. The outside of pipe and fittings within structures shall not be coated with the bituminous coating, but shall be thoroughly cleaned and given one shop coat of Intertol Rustinhibitive Primer 621 made by Koppers Co., Inc., Pittsburgh, Pa.; Multiprime made by PPG Industries, Inc., Pittsburgh, Pa.; Chromox 13R50 Primer made by Mobil Chemical Co., Edison, NJ; or an acceptable equivalent product.
2. Outside surfaces of castings to be encased in concrete shall not be coated. Castings encased in concrete shall be wrapped in poly
3. Machined surfaces shall be cleaned and coated with a suitable rust-preventative coating at the shop immediately after being machined.

PART 3 EXECUTION

3.01 HANDLING

A. Pipe and Fittings

1. Care shall be taken in handling and installing pipe and fittings to avoid damaging the pipe, scratching or marring machined surfaces, and abrasion of the pipe coatings.
2. Any fitting showing a crack and any fitting or pipe which has received a severe blow that may have caused an incipient fracture, even though no such fracture can be seen, shall be marked as rejected and removed at once from the Work.
3. In any pipe showing a distinct crack and in which it is believed there is no incipient fracture beyond the limits of the visible crack, the cracked portions, if so approved, may be cut off by and at the expense of the Contractor before the pipe

is installed so that the pipe used is perfectly sound. The cut shall be made in the sound barrel at a point at least 12-inches form the visible limits of the crack.

3.02 CUTTING

A. Pipe

1. Except as otherwise approved, all cutting shall be done with a machine having rolling wheel cutters, knives, or saws adapted to the purpose. Hammer and chisel or so-called wheel span cutters shall not be used to cut pipe. All cut ends shall be examined for possible cracks caused by cutting.

3.03 INSTALLATION

A. Pipe and Fittings

1. No defective pipe or fittings shall be installed or placed in the Work, and any piece discovered to be defective after having been installed or placed shall be removed and replaced by a sound and satisfactory piece.
2. Each pipe and fitting shall be cleared of all debris, dirt, etc., before being installed and shall be kept clean until accepted in the complete work.
3. Pipe and fittings shall be installed accurately to the lines and elevations indicated on the drawings or required. Care shall be taken to ensure a good alignment both horizontally and vertically.

B. Castings

1. Castings to be encased in masonry shall be accurately set with the bolt holes, if any, carefully aligned.
2. Immediately prior to being set, castings shall be thoroughly cleaned of all rust, scale and other foreign material.

C. Appurtenances

1. All valves, fittings and appurtenances shall be set and jointed as indicated on the Drawings.

3.04 ASSEMBLING

A. Bolted Joints

1. Before the pieces are assembled, rust-preventive coatings shall be removed from machined surfaces.
2. Pipe ends, sockets, sleeves, housings, and gaskets shall be thoroughly cleaned and all burrs and other defects shall be carefully smoothed.

B. Flanged Joints

1. Flanged joints shall be made up tight, care being taken to prevent undue strain upon pump nozzles, valves, and other pieces of equipment.

3.05 PIPING SUPPORT

A. In accordance with Section 15140.

B. The Contractor shall furnish and install all supports necessary to hold the piping and appurtenances in a firm, substantial manner (as determined and/or directed by the Engineer) at the lines and grades indicated on the drawings or specified. The design and fabrication of such supports shall be the responsibility of the Contractor as part of the work.

C. All pipe and appurtenances connected to equipment shall be supported in such a manner as to prevent any strain being imposed on the equipment. When manufacturers have indicated requirements that piping loads shall not be transmitted to their equipment, the Contractor shall submit a certification from the manufacturer stating that such requirements have been complied with.

D. Piping within buildings and structures shall be adequately supported from floors, walls, ceilings and beams. Supports from the floor shall be by approved saddle stands or suitable concrete or brick piers as indicated or approved by the Engineer. Pipe saddles shall be shaped to fit the pipe with which they will be used and shall be capable of screw adjustment. Concrete piers shall conform accurately to the bottom one-third to one-half of the pipe. Piping along walls shall be supported by approved wall brackets with attached pipe rolls or saddles or by wall brackets with adjustable hanger rods. For piping supported from the ceiling, approved rod hangers of a type capable of screw adjustment after erection of the piping and with suitable adjustable concrete inserts or beam clamps shall be used.

3.06 CLEANING

A. Prior to the pressure and leakage tests, the piping shall be thoroughly cleaned of all dirt, dust, oil, grease and other foreign material. This work shall be done with care to avoid damage to linings and coatings.

3.07 PRESSURE AND LEAKAGE TESTS

A. Except as otherwise directed, all pipelines shall be given combined pressure and leakage tests in sections of approved length.

B. The Contractor shall furnish and install suitable temporary testing plugs or caps; all necessary pressure pumps, pipe connections, meters, gages, relief valves, and other necessary equipment; and all labor required, to test the pipe specified in this Section.

C. Subject to approval and provided that the tests are made within a reasonable time considering the progress of the project as a whole, and the need to put the section into service, the Contractor may make the tests when he desires.

D. However, pipelines embedded in concrete shall be tested prior to placing of the concrete and exposed piping shall be tested prior to field painting.

E. 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. If hydrants or blow offs are not available at high points for releasing air the Contractor shall make the necessary taps at such points and shall plug said holes after completion of the test.

F. The section under test shall be maintained full of water for a period of 24 hours prior to the combined pressure and leakage test being applied.

G. The pressure and leakage test shall consist of first raising the water pressure (based on the elevation of the lowest point of the section under test and corrected to the gage location) to a pressure in pounds per square inch numerically equal to the pressure rating of the pipe but not to exceed 200 psi. Care shall be taken not to apply this pressure to items of equipment known to be incapable of withstanding such pressure.

H. If the Contractor cannot achieve the specified pressure and maintain it for a period of one hour with no additional pumping, the section shall be considered as having failed to pass the test.

I. If the section fails to pass the pressure and leakage test, the Contractor shall do everything necessary to locate, uncover, and repair or replace the defective pipe, fitting, or joint, all at his own expense and without extension of time for completion of the work. Additional tests and repairs shall be made until the section passes the specified test and is considered acceptable by the Engineer.

J. If, in the judgment of the Engineer, it is impracticable to follow the foregoing procedure exactly for any reason, modifications in the procedure may be made as required and approved by the Engineer, but in any event the Contractor shall be fully responsible for the ultimate tightness of the line within the above leakage and pressure requirements.

3.08 DISINFECTING AND FLUSHING

A. Provide the disinfection, testing and flushing requirements specified in Specification Section 02675 – Disinfection of Water Mains

3.09 PAINTING

A. The shop coats to be given pipe and fittings are specified under article 2.06 FINISHES.

B. Field painting is Specified in SECTION 09900 - FIELD PAINTING.

END OF SECTION

SECTION 15100

VALVES, GATES AND APPURTENANCES

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes

1. Requirements for furnishing and installing valves, gate valves and miscellaneous piping appurtenances, as indicated on the Drawings and as specified.
2. The Drawings and Specifications direct attention to certain features of the equipment, but may not cover all the details of their design. The equipment furnished shall be designed and constructed equal to the high quality equipment manufactured by such firms as mentioned, or as permitted by the Engineer. The Contractor shall furnish and install the equipment complete in all details and ready for operation.

B. Related Work

1. Section 09900 - Painting

1.02 DESIGN REQUIREMENTS

A. Enclosures shall be suitable for the atmosphere in which they are installed.

1.03 REFERENCES

A. American Society for Testing and Materials (ASTM)

1. A126, Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings
2. A536, Standard Specification for Ductile Iron Castings
3. B62, Standard Specification for Composition Bronze or Ounce Metal Castings
4. D429, Standard Test Methods for Rubber Property—Adhesion to Rigid Substrates

B. American Water Works Association (AWWA)/American National Standards Institute (ANSI)ANSI/AWWA C110/A21.10, Standard for Ductile Iron & Gray-Iron Fittings 3 in through 48 in for Water and Other Liquids

1. ANSI/AWWA C111/C21.11, Standard for Rubber-Gasket Joints for Ductile-Iron and Pressure Pipe and Fittings
2. ANSI/AWWA C500, Standard for Metal-Seated Gate Valves for Water Supply Service.
3. ANSI/AWWA C504, Rubber-Sealed Butterfly Valves
4. ANSI/AWWA C509, Resilient-Seated Gate Valves for Water-Supply Service
5. ANSI/AWWA C515, Reduced Wall Resilient Seated Gate Valves for Water Supply Service

6. ASME/ANSI B16.1/B16.5, Cast Iron Pipe Flanges and Flanged Fittings/ Pipe Flanges and Flanged Fittings
7. AWWA C550, Protective Epoxy Interior Coatings for Valves and Hydrants
8. AWWA C606, Grooved and Shouldered Joints

1.04 SUBMITTALS

A. Submit in accordance with Section 01300 – Submittals

1. Manufacturer's specifications, catalog data, descriptive matter, illustrations, diagrams etc.

PART 2 PRODUCTS

2.01 SURGE RELIEF VALVE

A. Valves shall be first quality, free from all imperfections and defects and shall incorporate the following features:
   1. The relief valve shall be capable of rapid opening whenever the line pressure exceeds its setting.
   2. The relief valave shall include a surge control to anticpate the surge wave by monitoring the line pressure and opening when an unusual drop in pressure occurs. Valve operation shall be purely hydraulic requiring no electrical power. A relief pilot shall have over-riding control at all times.
   3. The relief valve shall be ruggedly constructed with a size 4-inch 125 lb./250 lb. flanged, full ported globe/angle body design.
   4. The relief valve shall be fully bronze mounted, external pilot operated, with free floating piston (operated without springs, diaphragm or levers), single seat with seat bore equal to size of valve.
   5. The minimum travel of the piston shall be equal to 25% of the diameter of the seat.
   6. For true alignment (to correct lateral thrust and stem binding) the piston shall be guided above and below the seat a distance equal to no less than 75% of the diameter of the seat.
   7. The piston shall carry a contoured cushion device that will cause a gradual change in flow area as the valve approaches the seat. The cushion device must move with the piston to minimize the head loss when the valve is fully opened and so designed as to insure positive closure.
   8. The main valve shall be packed with leather (or other soft material) to insure tight closure and prevent metal to metal friction and seating.
   9. The main valve shall include a position indicator rod to show position of opening of the piston.
   10. The relief valve shall have a limit switch attached to the position indicator to provide open/close indication to the pump stationi instrumention and control systems. Refer to Electrical and I&C drawings and specifications.
   11. The main valve will include gauge cocks for testing purposes.

12. The pilot valve, controlling operation of main valve, shall have a range for adjustment, be easily accessible and so arranged to allow for its removal from the main valve while the main valve is under pressure.
13. The pilot valve and all associated piping and fittings necessary for proper operation shall be factory assembled and furnished with the relief valve.
14. Ball valves shall be installed in the control piping to completely isolate the pilot valve when conditions may require pilot isolation for maintenance or repair.
15. An external strainer with blow off will be provided to protect the pilot and speed control valves.
16. The design shall be such that repairs and dismantling internally of the main valve may be made without its removal from the line.
17. The valve shall be constructed of first class grey iron, free of cold shuts, defective or spongy spots and conforming to ASTM specification A-126 Class B.
18. The seat disc, external pilot valve, internal piston, seat ring, stem nuts, seat packing, position indicator, and bottom cap cylinder shall be bronze, conforming to ASTM specification B-62.
19. The strainer shall be bronze body with stainless steel screen.
20. The ball valves shall be full ported with stainless steel shaft, nut and adjusting handle.
21. The bottom cap cylinder shall be bronze and teflon coated. The Teflon shall be applied in two parts: Part 1 shall be a primer Teflon coating with a minimum thickness of 5 mils. Part 2 shall be a finish coat of Teflon TFE with a minimum thickness of 5 mils. for a final coat minimum thickness of 10 mils.

B. Pressure relief valve shall be Model 50RWR-A, globe body, manufactured by Ross Valve Manufacturing Company, or approved equal.

2.02 RESILIENT SEAT GATE VALVES

A. Manufactured by American Flow Control, Birmingham AL; Kennedy Valve, Elmira, N.Y. or approved equal.

B. Gate Valves 2 inches and larger

1. Iron-body, resilient-wedge or double disk as specified.
2. Mechanical joint or flanged ends as indicated on the Drawings or herein specified.
3. All valves shall be designed for a minimum of 250 psi working pressure.
4. Face-to-face dimensions of flanged valves shall conform to the ANS B16.10.
5. Stem material shall be silicon bronze or an acceptable equivalent having high resistance to dezincification.
6. All exposed nuts, bolts and washers shall be stainless steel.
7. Valves shall be capable of being repacked under line pressure.
8. Valves shall be turned to the **left (counterclockwise)** to open.
9. Coatings

a. Exterior and interior surfaces of all valves shall be coated by the valve manufacturer prior to shipment.
b. The coating shall be applied and cured in strict conformance with the coating manufacturer's cautions and instructions.
c. The coating shall be applied by the valve manufacturer under controlled factory conditions, and field application is strictly prohibited.
d. The coating shall be a fusion bonded epoxy-protective coating system which meet all requirements of AWWA C550.

C. Gate valves 2 inches and smaller

1. 200 lb. WOG minimum bronze valves with screwed ends to suit the piping in which they are installed.
2. Body material shall conform to ASTM B62.
3. Valves shall have union bonnet, rising stem, inside screw, and solid wedge gate.

D. Process Valves

1. In accordance with AWWA Specification C-515.
2. Iron body, bronze trim, solid wedge with tapered seat or double revolving disc, parallel seat construction.
3. If of the parallel seat type, the discs and wedges shall be free of pockets and rib.

E. Potable Water Valves

1. Gate valves shall be resilient seated wedge type in accordance with AWWA C515.
2. Valve bodies to be of ductile iron.
3. Gate valves shall be resilient seated gate valves with **OS&Y (rising stem)**.
4. Rising stems shall be bronze.
5. Valves shall have a two-inch operating nut or hand-wheel as required for the particular application and as shown on the drawings.
6. Coating
   a. The AWWA C550 epoxy coating shall not impart taste or odors to the water. The coating shall be a product acceptable to the NSF for use in potable water and shall be so listed in the most current NSF summary of approved products (ANSI/NSF Standard 61).

F. Interior Valves

1. Stuffing box follower bolts shall be of steel and the nuts shall be of bronze.
2. Hand wheel with chain operator for valves with operating stem height six (6) feet above finished floor.
3. Valves to have rising stems
4. Flanged unless otherwise shown on the drawings.
5. Flanges shall be drilled to the ANSI 125/150 pound standard.

G. Actuators

1. Means of actuation by wheel, lever, tee wrench, or motorized actuator, as specified or as shown on the drawings.
2. Interior gate valves
   a. Hand-wheel operated.

b. Hand wheels shall be of ample size for ease of operation and shall have an arrow and the work OPEN cast thereon to indicate the direction of opening.

3. Valves 12 inches and larger
   a. Equip valves 12 inches and larger with gear actuators.
   b. Actuator gear box shall be of totally enclosed oil or grease bath lubricated type, suitable for operation at any angle and provided with the appropriate filling and drain plugs.
   c. Shaft bearings furnished with permanently lubricated bronze bearing bushings.
   d. Actuator shall clearly indicate valve position and an adjustable stop shall be provided.
   e. Construction of actuator housing shall be semi-steel with exposed nuts, bolts, and washers to be zinc plated.
   f. All valve actuators shall be as recommended by the valve manufacturer.

2.03 SAMPLE TAP

A. Manufactured by Matco Norca or approved equal.

B. General

1. Sample tap shall be consistent with sampling needs and should not be of the petcock type. Sample tap shall be of the smooth-nosed type without interior or exterior threads, shall not be of the mixing type, and shall not have a screen, aerator, or other such appurtenance.

C. Construction

1. Sample tap shall be certified lead free and the bonnet, stem and body shall be constructed of chrome plated brass.
2. The washer shall be constructed of 304 stainless steel.
3. The seat packing shall be constructed of Buna SN-719F.
4. Sample tap shall have a ½" MIP inlet and plain end outlet.

2.04 BUTTERFLY VALVES.

A. General

1. Semi-steel bodies as specified under ASTM A-126, Class B, close nickel alloy iron with solid one-piece stainless steel shaft and constant contact with the disc to provide strength and rigidity.
2. Valve shall be of the lug body type for use between 125/150 ANSI flanges.
3. Shaft shall be ground and polished to minimize bearing and seal wear.
4. Packing shall be multiple ring type packing.

B. Construction

1. Valves shall have reinforced Teflon corrosion resistant bearings with phenolic back to assure smooth valve operation.
2. Valves shall have universal actuator mounting for field interchangeability.
3. Valve disc shall be secured to shaft by means of wedge shaped 304 stainless steel tangible pins driven flat against the valve shaft and held in place by threaded pipe plugs.

4. Disc material shall be semi-steel with welded nickel edge to provide corrosion resistance and to minimize undue seat wear. The resilient seat shall be bonded to a bronze retention ring and shall be held in place by stainless steel retaining screws. Retaining screws shall allow seat adjustment. A thrust bearing shall be provided at the bottom of the shaft to assure proper disc to seat alignment and absorb shaft thrust.

C. Operation

1. Valves shall be operated by a means of an enclosed hand wheel.
2. Actuator gearings shall be enclosed suitable for running in oil with seals provided on all shafts to prevent entry of dirt and water into the actuator.
3. Shaft bearings shall be furnished with permanently lubricated bronze bearings and bushings.
4. Actuators shall clearly indicate valve position and an adjustable stop shall be provided to closing torque.
5. A maximum of 18 turns shall actuate the valve from fully closed to fully open.

D. Valves shall be by DeZurik, Keystone or approved equal.

2.05 GLOBE VALVES

A. Valves shall have bronze body and fittings and shall be hand-wheel operated.

B. Discs shall be bronze and renewable type.

C. Valves shall be designed for 150 psi working pressure and shall have threaded connections unless otherwise specified.

D. Valves shall be by Powell, Stockham or approved equal.

2.06 NEEDLE VALVES

A. Bronze bodies with screwed ends and long tapered plugs and seating surfaces suitable for close regulation of flows.

B. In sizes up to 3/4 inches, spindles and seats shall be bronze. Valves shall be Walworth Co. No. 120; Crane Co. No. 88; Jenkins Bros., No. 741-G; or acceptable equivalent product.

C. In sizes over 3/4 inches, tapered plug type globe or angle valves as specified shall be used.

2.07 CHECK VALVES

A. Check valves 3 inches and larger

1. Iron-body, bronze-mounted, full-opening, swing-type check valves with bolted covers and flanged ends.
2. Flanges shall be faced and drilled in accordance with the 125-lb. AN Standard.
3. Valves shall have bronze faced cast iron disc plate suspended at the top from a stainless steel shaft.

4. Valve shaft shall be supported by bronze bushings and bearings and shall be packed through externally accessible stuffing box.
5. Disc shall seat against resilient seat installed in the valve body.
6. Valve closure shall be assured by means of outside lever and weight.
7. Coating
8. Check valves shall be AWWA compliant and meet NSF compliant.
9. Shop primed on the outside with a rust inhibitive priming system.

B. Check valves smaller than 3-inches

1. 300 pounds bronze curving design with screwed-in bonnet, regrinding bronze disc, and screwed ends.
2. Disc shall be suspended at the top with a stainless steel shaft.
3. All check valves shall be horizontally mounted.

2.08 BALL VALVES.

A. General

1. Straight-through passageway, and shall be of the full-port design.
2. Rated for 150-psi service.

B. Construction

1. Type 316 stainless steel, except for those valves specified PVC construction or installed in PVC piping or indicated otherwise on the Drawings.
2. Body shall be of rigid construction and symmetrically cast.
3. The shaft and ball shall be integrally cast.
4. Seats and seals shall be Teflon and shall be recessed in a machined groove.
5. Shaft packing
   a. Braided band.
   b. Tightened by means of a gland bearing strip.
   c. Replacement of the packing shall be accomplished without removing the actuator.

C. Valves shall be by Apollo or approved equal.

2.09 PVC VALVES

A. General

1. Polyvinyl Chloride (PVC) valves shall be manufactured of the same PVC Type 1 Grade 1 molding compound used for the fittings to assure proper compatibility of system components.

B. Ball valves and ball check valves

1. True union PVC valves.
2. Design to allow for entire valve body removal by turning back the union nut at both ends of the valve.
3. Teflon seats and packing.
4. Pressure rating of 150 psi at 75 degrees F water.

C. Diaphragm Valves

1. Constructed of PVC, except diaphragm, including bonnet and hand wheel.
2. Diaphragm shall be replaceable and fully supported in any position.
3. Non-rising stem with a diaphragm position indicator.
4. Diaphragm constructed of Teflon and be replaceable without removing valve from the line.
5. Valve shall be socket ends.
6. Valves shall be by Nibco or approved equal.

D. The valves shall be pneumatically or manually operated as shown on the drawings. Valve operators shall be supplied as specified under the valve operation Section 2.10.

2.10 VALVE OPERATORS

A. Valve operators shall be designed in accordance with the requirements of AWWA Specifications, C504-80 and shall furnish sufficient torque to open and close at 125 percent of the rated working pressure for the valve.

B. Valves 6 inches and larger shall be gear operated with hand wheels and valves smaller than 6-inches shall be wrench operated, except as hereinafter specified or indicated on the drawings.

C. Where there is a lack of space for the valve wrench to operate gear-operators, hand wheels shall be provided in lieu of the wrench.

D. Chain operators, consisting of sprocket wheels, chain guides and operating chains shall be provided for all valves with operator centerlines located more than 6 feet - 6 inches above the operating level. Operating chain shall be galvanized and shall extend within 3 feet of the operating level. Operators shall develop their maximum capacity with not greater than a 40-lb. pull on the wheel.

E. Gear operators shall be totally enclosed, worm-gear type, permanently lubricated, and shall be watertight and dust tight.

F. Gear operators shall be provided with adjustable stops for the open and closed position to prevent over travel, and shall have a valve disk position indicator.

G. A suitable lever or wrench shall be provided for each six wrench-operated valves and at least one wrench for each operating station. Wrenches or wheels and chains shall be of suitable size and sufficient length for easy operation of the valves at their rated working pressure.

H. The valve assembly including valve and operator shall be tested to requirements specified herein at the valve manufacturer's factory.

2.11 VALVE EXTENSION STEMS.

A. General

1. Furnish as required and as shown on the Drawings.

2. Shaft lengths shall suit the particular installation.
3. Stems shall have a two-inch operating nut and a two-inch coupling for connection of the valves.

2.12 SOLENOID VALVES

A. General

1. Direct acting packless two-way solenoid valve for water service.
2. Normally closed, unless otherwise shown.
3. Provide for operation with 120 volt, 60 Hertz power and have continuous duty Class A insulation.
4. Valve body to be forged brass with safe body working pressure of at least 250 psi.
5. NPT connections unless indicated otherwise.
6. Buna-N seat.
7. Wetted parts to be stainless steel.

B. Valves shall operate satisfactorily when mounted in any position.

C. Valves shall be by ASCO or approved equal.

D. Provide enclosures to meet NEMA Type 4X requirements with coils epoxy encapsulated and suitable for high ambient temperatures (140 degrees F).

2.13 PRESSURE REDUCING VALVES (TWO INCHES AND SMALLER)

A. General

1. Single seated balanced design type globe body with threaded inlet and outlet ports.
2. Valves shall be diaphragm operated, spring loaded, and permitting convenient adjustment.

B. Construction

1. The body shall be of bronze construction with stainless steel stem.
2. Furnished with a replaceable rubber seat.

C. Valves shall be G-A Industries Figure 43-D, Watts No. 223, or approved equal.

2.14 VALVE TAGS.

A. General

1. 1 ½ inch, square, brass.
2. Stamped ½ inch characters to be black filled.
3. Numbered to owners identification system, if no system is required then number sequentially.
4. Provide each tag with No. 16 brass jack chain in suitable length to attach tag to valve.

2.15 ELASTOMERTIC “DUCKBILL” CHECK VALVES

A. Valve body

1. Two-piece split configuration, of cast iron. The two halves shall be sealed by rubber sheet gaskets that are cut to match the profile of the body halves.
2. The flanges shall be drilled to mate with ANSI B16.1, Class 125/ ANSI B16.5 Class 150 flanges, and port areas shall be 100% of the mating pipe port area.
3. Valve body shall be drilled and tapped for a supplied clean out plug on the top of the body and flushing connections on the bottom of the body supplied with plugs.

B. Check sleeve

1. One-piece rubber construction with fabric reinforcement.
2. Inlet port shall have an integral flange, drilled to be retained by the flange bolts and acting as the gasket between pipe and valve.
3. The integral flange will be drilled to ANSI B16.1, Class 125/ ANSI B16.5 Class 150 standards, and the inlet port area shall be 100% of the mating pipe port area.
4. The port area shall contour down to a duckbill, which shall allow passage of flow in one direction while preventing reverse flow.

C. Manufacturer must have available flow test data from an accredited hydraulics laboratory to confirm pressure drop data. Company name and location shall be cast onto the valve body.

D. Operation

1. When line pressure inside the valve exceeds the backpressure outside the valve by a certain amount, the line pressure forces the bills of the valve open, allowing flow to pass.
2. When back pressure exceeds the line pressure by at the same amount, the bills of the valve are forced closed.

E. Manufacture

1. All elastomeric “duckbill” check valves shall be Series 39 as manufactured by the Red Valve Co., Inc. of Carnegie, PA, or approved equal.

2.16 BACKFLOW PREVENTERS

A. Domestic Water Feed.

1. Manufactured by Ames, or equal.
   a. Series 009, reduced pressure type, AWWA C506, two spring-loaded check valves, differential pressure-relief valve, common housing, gate valve for preventer ends, brass test cocks, and manufacturer supplied spare parts and gauge method test kit. Furnish with in-line strainer with blow-off valve, air gap drain fitting.

PART 3 EXECUTION

3.01 GENERAL

A. Valves shall be installed as nearly as possible in the positions indicated on the drawings consistent with conveniences of operating the hand wheel or wrench. All valves shall be carefully erected and supported in their respective position free from all distortion and strain in appurtenances during handling and installation. All material shall be carefully inspected for defects in workmanship and material, all

debris and foreign material cleaned out of valve openings and seats, all operating mechanisms operated to check their proper functioning, and all nuts and bolts checked for tightness. Valves and other equipment which do not operate easily or are otherwise defective shall be repaired or replaced at the Contractor's expense.

B. Valves shall not be installed with stems below the horizontal.

C. Valves shall be set plumb and supported adequately in conformance with the instructions of the manufacturer. Valves mounted on the face of concrete shall be shimmed vertically and grouted in place. Valves in the control piping shall be installed so as to be easily accessible.

D. Where chain wheels are provided for remote operation of valves two S-shaped hooks shall be provided for each valve to enable the chains to be hooked so as not to interfere with personnel traffic.

E. A permanent type gasket of uniform thickness shall be provided between flanges of valves and sluice gates and their wall thimble.

F. Wall thimbles shall be accurately set in the concrete walls so that the gates can be mounted in their respective positions without distortion or strain.

3.02 VALVE TAGS.

A. Tag valve in visible location, free from interference with operating device, other equipment and personnel.

B. Develop and provide to Owner, valve chart indicating all valves with corresponding identification number.

3.03 PAINTING

A. Shop and Field Painting shall be as specified under SECTION 09900.

END OF SECTION

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SECTION 15130

GAUGES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Requirements to furnish and install gauges at locations indicated on the Drawings and as specified.

PART 2 PRODUCTS

2.01 GENERAL

A. Gauges include pressure, vacuum and compound gauges of the dial indicating Bourdon tube-type.

B. Gauges shall be Helicoid Gauges as manufactured by the American Chain and Cable Co., Ashcroft Duragauges by Manning, Maxwell and Moore, Inc., or approved equal.

C. Pressure gauges shall be designed to indicate pressures above atmospheric pressure only.

D. Vacuum gauges shall be designed to indicate pressures below atmospheric pressure only.

E. Compound gauges shall be designed to indicate pressures above and below atmospheric pressure.

2.02 LOCATION

A. Gauges shall be provided where shown on the Drawings, specified in the Specifications or required for a complete installation. Indicating pressure gauges shall be provided downstream of each pressure regulating valve where shown, specified or required; in the seal water piping of each pump; and on both the suction and discharge piping of each pump except where otherwise specified.

2.03 ACCURACY

A. Grades of accuracy shall conform to the requirements of American Standard A.S.A. B40.1. The Contractor shall submit manufacturer's certifications indicating that the gauges provided have met the accuracy requirements specified.

B. Pressure, vacuum and compound gauges shall be Grade AA gauges with an error not exceeding ½ of 1 percent of full-scale range.

C. Gauges with a flexible seal between the Bourdon tube and the medium to be measured shall have an overall accuracy of Grade A with an error not exceeding one percent of scale range for the middle half and 1-1/2 percent for the remainder of the scale.

2.04 GAUGE CONSTRUCTION

A. Gauges shall be weatherproof, designed and constructed to meet all requirements for satisfactory operation.

B. Pressure, vacuum and compound gauges shall be constructed of sound, durable material, free from all defects and imperfections that in any way may affect the accuracy and serviceability of the gauges.

C. Gauge cases shall be of aluminum, phenolic or polypropylene. Dial shall be 4 1/2 inches nominal diameter with black lettering and scales on a white background, and shall bear a legend showing service and units of graduation. Gauge dial shall be clear and blemish free and sealed to prevent entrance of moist air. Bourdon tube shall be phosphor bronze with forged brass socket. Set point shall be of stainless steel. Socket stem shall extend at least 1-1/4 inches below the gauge case and shall have a large wrench flat.

D. Pressure gauges shall be graduated in psi unless otherwise specified. Vacuum gauges shall be graduated in inches of mercury; compound gauges shall be graduated in inches of mercury, psi or feet of water as specified.

E. Maximum scale reading for pressure and compound gauges shall be approximately twice the maximum operating pressure of the fluid to be measured. Vacuum and compound gauges shall have minimum scale readings at 30 inches of mercury unless otherwise shown or specified.

F. Unless otherwise shown or specified, all pressure, vacuum and compound gauges shall have bottom 1/2-inch NPT male connections.

2.05 DIAPHRAGM PROTECTED GAUGES

A. The Contractor shall provide diaphragm seals on sludge gauges to prevent the fluid to be measured from clogging or corroding the Bourdon tube of pressure, vacuum and compound gauges.

B. Diaphragm seals shall be suitable for the gauge furnished; gauges to be used with diaphragm seals shall be Grade AA gauges conforming to the requirements specified herein. Chemical gauges shall have the diaphragm seal as an integral part. Overall accuracy for diaphragm protected units shall be Grade A.

C. Diaphragms shall have an overall diameter of not less than 2-1/2 inches and shall be made of a material that is corrosion resistant and compatible with the process fluid. Diaphragm protected gauges shall be factory filled with Glycerin oil or approved equal and calibrated by the gauge manufacturer. Unless specified otherwise, diaphragm protected gauges shall be provided with sintered metal snubbers or pulsation dampers.

D. Diaphragm housing assembly shall be of durable stainless or cadmium plated with a ¾ inch NPT process connection. The lower housing shall have a 1/4 inch NPT flushing connection and 1/4 inch NPT plug, to allow venting or the introduction of cleaning fluid on the process side of the diaphragm seal. The bottom housing shall be made of a material that is corrosion resistant and compatible with the process fluid. A clean out ring shall be provided to hold the diaphragm captive in the upper housing so that the assembly may be removed for

recalibration or cleaning of the process side without loss of instrument fluid. Diaphragm protected gauges and seals shall be ACCO Helicoid Diaphragm Seal Type 100 HACF, Ashcroft Diaphragm Seal Type 101, or equal.

2.06 GAUGE PROTECTION AND ACCESSORIES

A. Unless otherwise shown or specified, pressure gauges shall have under pressure protection and vacuum gauges shall have overpressure protection. For helical roller type pressure gauges, the gauge shall have a left hand movement for under pressure protection; for all other gauges, under pressure protection stops shall be provided. For vacuum gauges with helical roller movement, gauges shall have right hand movement for overpressure protection; all other gauges shall have suitable overpressure protection stops.

B. Unless otherwise shown or specified, all pressure, vacuum and compound gauges shall be provided with stainless steel sintered metal snubbers of porosity suitable for this service. Snubbers shall be ACCO Helicoid No. S-2 or S-4, Ashcroft Chemquip No. 1112S or equal.

C. Diaphragm protected gauges for normal service shall be provided with rough plumbing 3/4 inch stop valves for shut-off cocks, and ¾ inch red brass pipe. Valves shall have a bronze body, stainless steel ball, and teflon seats, valves shall have a spring-closing handle.

D. Gauges other than diaphragm protected gauges shall be installed complete with incidental shut-off cock and tees with test cock with a female outlet. All pipe and fittings shall be brass. The gauge shall be mounted directly in the outlet of the tee-bearing test cock.

END OF SECTION

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SECTION 15140

PIPE HANGERS AND SUPPORTS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes

1. Furnish all labor, materials, equipment and incidentals required to install, and make completely ready for operation, pipe hangers, supports, concrete inserts, and anchor bolts including, metallic hanging and supporting devices as specified herein and as shown on the Drawings.

B. Related work

1. Section 03300 – Cast-In-Place Concrete
2. Section 09900 – Painting

1.02 REFERENCES

A. American Society of Mechanical Engineers (ASME)

1. ASME B31.1, Power Piping

B. Manufacturers Standardization Society Standard Practice (MSS-SP)

1. MSS-SP-58, Pipe Hangers and Supports, Materials, Design and Manufacture.
2. MSS-SP-69, Pipe Hangers and Supports, Selection and Application.

1.03 REQUIREMENTS

A. Design Requirements

1. The equipment specified herein is intended to support the various types of pipe and piping systems required for the Work.
2. The details shown on the Drawings are intended to indicate the generally desired methods of support under normal conditions.
3. All supports shall be designed to adequately secure the pipe against excessive dislocation due to thermal expansion and contraction, internal flow forces, and all probable external forces such as equipment, pipe, and personnel contact through 360 degrees in all three dimensions.
4. It shall be the responsibility of the Contractor to provide a Professional Mechanical Engineer licensed in the **Commonwealth of Massachusetts**, with a minimum of 5 years of demonstrated experience in the design of supports and connections, to design the supports and connections for all equipment for all weights and applied pressures as indicated on the Drawings.
5. In the design of hangers, supports and anchors, pipe pressures shall be taken as the maximum rated pressure specified for pipe lines carrying gases and air and twice the maximum rated pressure specified for pipe lines carrying liquids.
6. Payment for such design services shall be included in the Prices bid for furnishing and installing pipe lines.

7. Hangers and supports shall be of approved standard design where possible and shall be adequate to maintain the supported load in proper position under all operating conditions.
8. All supporting equipment, with the exception of springs, shall be designed with a minimum working factor of safety of five based on the ultimate tensile strength of the material.
9. Where additional structural members are required, they shall be designed for the specific loads they are to support in accordance with the requirements of **Commonwealth of Massachusetts Building Code.**

B. Performance Requirements

1. All hangers, supports and appurtenances shall conform to the latest requirements of the following listed references except as supplemented or modified by the requirements of this Specification.
   a. ANSI B 31.1.
   b. MSS-SP-58.
   c. MSS-SP-69.

1.04 SUBMITTALS

A. In accordance with SECTION 01300.

1. Representative catalog cut for each different type of pipe hanger or support indicating the materials of construction, important dimensions and range of pipe sizes for which that hanger is suitable. Where standard hangers are not suitable, submit detailed drawings showing materials and details of construction for each type.
2. Complete piping drawings indicating type of hanger, location, and magnitude of load transmitted to the structure. Submittals shall use detail numbers as shown on the Drawings to indicate type of support proposed wherever possible.

B. Design computations shall not be submitted for review. Any design computations submitted shall be returned without comment. A design certificate shall be submitted prior to installation of any piping.

1.05 DELIVERY, STORAGE AND HANDLING

A. All supports and hangers shall be crated, delivered and uncrated so as to protect against any damage.

B. All parts shall be properly protected so that no damage or deterioration shall occur during a prolonged delay from the time of shipment until installation is completed.

C. Finished iron or steel surfaces not galvanized or painted shall be properly protected to prevent rust and corrosion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Unless otherwise specified herein, pipe hangers and supports shall be as manufactured by the following:

1. Grinnell Corp., Providence, Rhode Island.
2. Carpenter & Patterson, Inc., Woburn, Massachusetts.
3. F&S Central, Brooklyn, New York.
4. Elcen Metal Products Co., Franklin Park, Illinois.
5. Unistrut Northeast, Woburn, Massachusetts

B. Any reference to a specific figure number of a specific manufacturer is for the purpose of establishing a type and quality of product and shall not be considered as proprietary. Any item comparable in type, style, quality, design and performance shall be considered as equal.

C. The Drawings and Specifications indicate general and specific methods and details of supporting the various piping systems. Any changes to the support details shown shall be submitted to the Engineer for review.

D. All uninsulated non-metallic piping such as PVC, fiberglass, etc. shall be protected from local stress concentrations, at each support point by galvanized steel protection shields or other method as approved by the Engineer where pipes are bottom supported 180 degree arc shields shall be furnished. Where 360 degree arc support is required, such as U Bolts, protection shields shall have a 50 mils minimum thickness, not be less than 12 inches in length and be securely fastened to pipe with stainless steel or galvanized metal straps not less than 1/2 inch wide.

E. All insulated pipe shall be furnished with a rigid foam insulating saddle at each pipe support location as specified under insulation. Provide galvanized protection shields as specified in Paragraph 2.01D above at each location.

F. Where pipe hangers and supports come in contact with copper piping provide protection from galvanic corrosion by the following:

1. Wrap pipe with 60 mils thick neoprene sheet material and galvanized protection shield.
2. Provide isolators similar to Elcen figure number 228.
3. Provide copper plated or PVC coated hangers and supports.

G. Pipe supports shall be provided as follows:

1. Cast iron soil pipe: maximum support spacing of 5.0 feet with a minimum of one support per pipe section at the joints.
2. Steel pipe: maximum support spacing of 10 feet with a minimum of one support per pipe section at the joints.
3. Fiberglass pipe: as recommended by the manufacturer except that support spacing shall not exceed 5 feet.
4. PVC pipe: as recommended by the manufacturer except that support spacing shall not exceed 3 feet. For pipe equal to or less than I inch in diameter and 5 feet for all other pipe sizes.
5. Support spacing for steel pipe 2 inches and smaller and copper tubing shall not exceed 5 feet.
6. Ductile iron pipe: maximum support spacing of 10 feet with a minimum of one support per pipe section at the joints.
7. All vertical pipe shall be supported at each floor or at intervals of not more than 12 feet by approved pipe collars, clamps, brackets, or wall rests, and at all points necessary to insure rigid construction.
8. Pipe supports shall not induce point loadings but shall distribute pipe loads evenly along the pipe circumference.

9. Effects of thermal expansion and contraction of the pipe shall be accounted for in the pipe support selection and installation.

2.02 SINGLE PIPE HANGERS

A. Single pipes shall be supported by hangers suspended by galvanized steel rods from structural steel members, concrete ceilings and beams, bottom of trapeze hangers and wall mounted steel angle brackets.

B. Hanger rods shall be hot rolled steel, machine threaded and galvanized after fabrication. The strength of the rod shall be based on its root diameter.

C. Except as otherwise specified herein, pipe hangers shall be adjustable clevis type similar to Grinnell Figure Numbers 65, 260, and 590 as required. Hangers shall be carbon steel with a galvanized finish.

D. Hanger rods shall be attached to concrete structures using concrete inserts similar to F&S Figures 180, 571 or 150. Inserts shall be malleable iron, or steel with galvanized finish. Beam damps, C clamps or welded beam attachments shall be used for attaching hanger rods to structural steel members. Where necessary and approved by the Engineer double expansion shields shall be used for attaching to concrete structures.

E. Where pipes are near walls, beams, columns, etc. and located an excessive distance from ceilings or underside of beams, welded steel wall brackets similar to Carpenter and Patterson Figure numbers 69-68, 84 or 139 shall be used for hanging pipe. Brackets shall be galvanized. Where single pipes rest on top of bracket pipe supports, attachments shall meet requirements as specified under multiple pipe hangers.

2.03 MULTIPLE PIPE HANGERS

A. Suspended multiple pipes, running parallel in the same horizontal plane, which are adjacent to each other shall be suspended by trapeze type hangers or wall brackets. Trapeze hangers shall consist of galvanized structural steel channel supported from galvanized threaded rod or attached to concrete walls, columns or structural steel support members as required to meet the intent of this specification. Channel shall be similar to F&S Figure 710, rods, concrete inserts, "C" Clamps, beam clamps, welded beam attachments, and expansion shields shall be as specified in 2.02 Single Pipe Hangers.

B. Except as otherwise specified herein pipe anchors used for attaching pipe to trapeze or multiple pipe wall brackets shall be anchor or pipe chair similar to F&S Figures 158, 419, 160A, 160B as required. Materials of construction shall be galvanized steel. Chair "U" bolts shall be tightened to allow freedom of movement for normal expansion and contraction except when pipe must be anchored to control direction of movement or act as a thrust anchor.

2.04 SINGLE AND MULTIPLE PIPE SUPPORTS

A. Single pipes located in a horizontal plane close to the floor shall be supported by one of the methods specified herein or as shown on the Drawings.

B. Pipes 3-inch diameter and larger shall be supported by adjustable stanchions similar to F&S Figure 427, constructed of galvanized steel. Stanchions shall provide at least 4-inch adjustment and be flange mounted to floor,

C. Pipes less than 3-inches in diameter shall be held in position by supports fabricated from steel "C" channel, welded post base similar to Unistrut Figure P2072A and pipe clamps similar to Unistrut Figures Pl109 thru Pl126. Where required to assure adequate support, fabricate supports using two vertical members and post bases connected together by horizontal member of sufficient load capacity to support pipe. Wherever possible supports shall be fastened to nearby walls or other structural member to provide horizontal rigidity. More than one pipe may be supported from a common fabricated support. All supports unless specified elsewhere shall be galvanized.

D. Where required, pipe shall be supported using concrete anchor posts constructed in accordance with SECTION 03300. Pipe shall be securely fastened to concrete anchor posts using suitable metal straps as required and approved by the Engineer.

2.05 WALL SUPPORTED PIPES

A. Single or multiple pipes located adjacent to walls, columns or other structural members shall whenever deemed necessary shall be supported using welded steel wall brackets similar to Carpenter and Patterson Figure numbers 69-78, 84, or 134; or "C" Channel with steel brackets similar to Unistrut pipe clamps. All members shall be securely fastened to wall, column, etc. using double expansion shields or other method as approved by the Engineer.

B. Pipe shall be attached to supports using methods hereinbefore specified to meet the intent of this Specification.

C. All supports shall be galvanized.

2.06 BASE ANCHOR SUPPORT

A. Where pipes change direction from horizontal to vertical via a bend, a welded or cast base anchor support shall be installed at the bend to carry the load. The bend anchor shall be fastened to the floor with double expansion shields or other method as approved by the Engineer.

B. Where shown on the Drawings, pipe bends shall be supported using concrete anchor posts. Pipes shall be securely fastened to concrete supports with suitable metal bands as required and approved by the Engineer.

2.07 VERTICAL PIPE SUPPORTS

A. Where vertical pipes are not supported by a Unistrut system as specified in Paragraph 2.08, they shall be supported in one of the following methods.

1. For pipes 1/4-inch to 2-inch in diameter, an extension hanger ring shall be provided with an extension rod and hanger flange. The rod diameter shall be as recommended by the manufacturer for the type of pipe be supported. The hanger ring shall be galvanized steel or PVC clad depending, on the supported pipe. The hanger ring shall be equal to

Carpenter & Peterson Figure number 81 or 81CT. The anchor flange shall be galvanized malleable iron similar to Carpenter & Patterson Figure number 85.

2. For pipes equal to or greater than 1/2-inch in diameter extended pipe clamps similar to Carpenter and Patterson Figure number 267 may be used. The hanger shall be attached to concrete structures using double expansion shields, or to steel support numbers using welding lugs similar to Carpenter & Patterson Figure number 220.
3. Pipe riser clamps shall be used to support all vertical pipes extending, through floor slabs. Riser clamps shall be galvanized steel similar to Carpenter & Patterson Figure number 126. Copper clad or PVC coated clamps shall be used on copper pipes. Insulation shall be removed from insulated pipes prior to installing riser damps.
4. Unless otherwise specified, shown, or specifically approved by the Engineer, vertical runs exceeding 11 feet, pipes shall be supported by approved pipe collars, clamps, brackets or wall rests at all points required to insure a rigid installation.

2.08 SPECIAL SUPPORTS

A. Pipe supports shal1 be provided for closely spaced vertical piping systems as shown on the Drawings or as otherwise required to provide a rigid installation. The support system shall consist of a framework suitably anchored to floors, ceilings and walls and be as manufactured by the Unistrut Corporation, Globe-Strut as manufactured by the Metal Products Division of U.S. Gypsum, or equal.

B. Vertical and horizontal supporting members shall be U shaped channels similar to Unistrut Series P1000. Vertical piping shall be secured to the horizontal members by pipe clamps or pipe straps equal to Unistrut series P1100M and series P2558. All components shall be of mild steel.

C. The assemblies shall be furnished complete with all nuts, bolts, and fittings required for a complete assembly including end caps for all members.

D. The design of each individual framing system shall be the responsibility of the Contractor. Shop drawings, as specified above shall be submitted and shall show all details of the installation, including dimensions and types of supports. In all instances the completed frame shall be adequately braced to provide a complete rigid structure when all the piping has been attached.

E. Any required pipe supports for which the supports specified in this Section are not applicable shall be fabricated or constructed from standard structural steel shapes in accordance with AISC Specifications, have anchor hardware similar to items previously specified herein, shall meet the minimum requirements listed below and be subject to the approval of the Engineer.

1. Pipe support systems shall meet all requirements of this Section and all related Sections of the Specification.
2. Complete design details of the entire pipe support systems shall be provided, for review by the Engineer.
3. The pipe support system shall not impose loads on the supporting structures in excess of the loads for which the supporting structure is designed.

2.09 SURFACE PREPARATION AND SHOP PAINTING

A. All surfaces shall be prepared and shop painted as part of the work of this Section. Surface preparation and shop painting shall be as specified in SECTION 09900.

PART 3 EXECUTION

3.01 INSTALLATION

A. Pipe and appurtenances connected to the equipment shall be supported in a manner to prevent any strain from being imposed on the equipment or piping system.

B. Pipe and tubing shall be supported as required to prevent damaging stresses in the pipe or tubing material, valves and fittings, and to support and secure the pipe in the intended position and alignment. Supports shall be sufficiently close together such that the sag of the pipe is within limits that will permit drainage and avoid excessive bending stresses from concentrated loads between supports.

C. Pipes, horizontal and vertical, requiring rigid support shall be supported from the building structure by approved methods. Supports shall be provided at changes in direction and elsewhere as shown in the Drawings or specific herein. No piping shall be supported from metal stairs, ladders and walkways unless specifically directed or authorized by the engineer.

D. Where flexible couplings are required at equipment, tanks, etc. the end Opposite to the piece of equipment, tank, etc. shall be rigidly supported.

E. Pipe supports shall be installed to minimize, lateral forces through valves, both sides of split type couplings and sleeve type couplings, and to minimize all pipe forces on pump housings. Pump housings shall not be utilized to support connection pipes.

END OF SECTION

CERTIFICATE OF DESIGN FOR PIPE HANGERS AND SUPPORTS

_____(Owner)

Contract Reference: _____

_____

_____, dated _____.

In accordance with the provisions of the above referenced Contract, as the designated Contractor,

_____

_____
(Contractor's Name and Address)

hereby certifies that _____

_____
(Contractor's Name and Address)

(1) Is properly licensed and currently registered as a Professional Engineer in the State (or Commonwealth) of _____;

(2) Is fully qualified to design and supervise the _____

_____
(Item of work and location)

In accordance with the provision specified under the appropriate Section and/or Subsections of the Contract Documents:

(3) Has successfully designed and supervised _____

_____
(Item of work)

before and demonstrates a minimum of ten (10) documented years of proven experience in such field;

(4) Has personally examined the type(s) and locations(s) of the Work required under this Contract, and the overall conditions associated therewith, to the extent necessary to fully satisfy his or her professional responsibilities for designing and supervising the above referenced work;

(5) Has prepared the attached design in full compliance with the applications and requirements of the Contract Documents, sound engineering practice, modern accepted principles of construction, and all applicable federal, state and local laws, regulations, rules and codes having jurisdiction over the Work;

(6) Will provide sufficient supervision and technical guidance to the Contractor throughout the Work to ensure compliance with the design and all quality assurances necessary to successfully complete the Work;

(7) Hereby indemnifies and holds harmless the _____

_____ and BETA Group, Inc.,
(name of owner)

and their agents, employees and representatives, from and against any and all claims, whether directly or indirectly, arising out of, relating to or in connection with the Work; and

(8) This "Certificate of Design" together with all applicable designs, drawings, details, specifications on other related documents necessary to complete the Work as specified, have been signed and sealed pursuant to applicable state law.

In recognition and observance of the above referenced statements, the undersigned parties hereby acknowledge and accept the responsibilities and obligations associated therewith.

CONTRACTOR:CONTRACTOR'S ENGINEER

_____	_____
(Contractor's Name)	(Engineer's Name)
_____	_____
By: _____	By: _____
_____	_____
(Name and Title)	(Name and Title)
Date: _____	Date: _____
(SEAL)	(P.E. STAMP)

(Note: Contractor to fully reference all attachments below)

_____

_____

_____

_____

_____

_____

END OF SECTION

SECTION 15400

PLUMBING

PART 1 - GENERAL

1.01 DESCRIPTION

A. The Work of this section includes all labor, tools, material, fittings, accessories and equipment necessary to provide plumbing system(s), complete and operable.

B. Attention is directed to the DOCUMENT 00700, GENERAL CONDITIONS and all sections within DIVISION 1 – GENERAL REQUIREMENTS, which are hereby made a part of this section of the Specifications.

C. The Work includes, without limiting the generality thereof:

1. Demolition of gas piping from existing riser supplying meter into building and all gas piping inside the building.

2. Water supply system

3. Domestic cold-water distribution system.

4. Domestic hot water and water heater.

5. Floor drains.

6. Wall hydrants.

1.02 SUBMITTALS

A. Shop drawings, brochures and samples, as listed, shall be submitted for all items to be furnished in accordance with the provisions of DOCUMENT 01300, SUBMITTALS.

B. Provide submittals for the following items consisting of manufacturer's published data. All submittals shall show compliance with the referenced specification.

1. Water and drain piping and fittings

2. Hangers and supports

3. Sleeves and escutcheons

4. Plumbing specialties

5. Valves

6. Domestic water heater

7. Floor drains

8. Mixing valve

9. Cleanouts

10. Piping insulation

1.03 RELATED WORK SPECIFIED ELSEWHERE

A. SECTION 02220, EARTHWORK - Excavation, filling, sheeting, shoring, pumping, dewatering.

B. SECTION 03300, CAST-IN-PLACE CONCRETE - for trench drains.

C. SECTION 07002, ROOF AND FLASHING - for roof penetrations.

D. SECTION 07841, PENETRATION FIRE STOPPING - for sleeves in floors and walls.

E. SECTION 07920, JOINT SEALANTS – caulking for sleeves in floors and walls.

F. SECTION 16120, WIRE AND CABLES - Power wiring.

1.04 ITEMS INSTALLED BUT NOT FURNISHED

A. Install water meter as furnished by the Owner.

1.05 DESIGN CRITERIA

A. The Work of this section shall comply with the requirements of the Massachusetts Uniform Plumbing Code (248 CMR) and of any other authorities having jurisdiction.

B. The equipment covered by the Specifications is intended to be standard equipment of proven quality as manufactured by reputable concerns. Equipment shall be designed, constructed and installed in accordance with the best practice of the industry and shall operate satisfactorily when installed in accordance with the Contract Documents. The Specifications call attention to certain details, but do not purport to cover all details entering into the construction of the equipment.

C. All material shall be new and shall bear the manufacturer's full identification.

D. Requirements of the Regulatory Agencies

1. The final, complete installation shall comply with all state and local statutory requirements having jurisdiction. Arrange for all necessary permits, pay all fees and arrange for all required inspections by local authorities. In general, all Work shall comply with the requirements of the rules, regulations, standards, codes, ordinances and laws of local, state and federal governments, and other authorities

that have legal jurisdiction over the Project. Materials and equipment shall be manufactured, installed and tested as specified in latest editions of applicable publications, standards, rulings and determinations of:

a. Local and state building, plumbing, mechanical, electrical, fire and health department codes.

b. American Gas Association (AGA).

c. National Fire Protection Association (NFPA).

d. Occupational Safety and Health Act (OSHA).

e. Underwriter's Laboratories (UL).

f. Material and equipment shall be listed by Underwriter's Laboratories (UL) and approved by ASME and AGA for intended service.

2. When requirements cited in the Specifications conflict with each other or with Contract Documents, most stringent shall govern Work.

3. Most recent editions of applicable specifications and publications of the following organizations form part of Contract Documents:

a. American National Standards Institute (ANSI).

b. American Society of Mechanical Engineers (ASME).

c. National Electric Manufacturers Association (NEMA).

d. American Society for Testing and Materials (ASTM).

e. American Water Works Association (AWWA).

f. American Society for Heating, Refrigerating and Air Conditioning Engineers (ASHRAE).

g. American Society of Plumbing Engineers (ASPE).

h. Thermal Insulation Manufacturers Association (TIMA).

i. Institute of Electrical and Electronics Engineers (IEEE).

j. Insulated Cable Engineers Association (ICEA).

k. Cast Iron Soil Pipe Institute (CISPI).

l. Plumbing and Drainage Institute (PDI).

m. National Association of Plumbing-Heating Cooling Sub-Contractors (NAPHCC).

1.06 PRODUCT HANDLING

A. All materials and equipment shall be shipped, stored, handled and installed in such manner as not to degrade quality, serviceability, or appearance.

B. Store all materials and equipment on site in a location approved by the Engineer.

C. Protect all Work, the Owner's property and the property of others from injury or loss caused by operations associated with the Work of this section. Make good any such injury or loss, at no cost to the party suffering the injury or loss.

1.07 PROCEDURE

A. Secure all permits, inspection, and approvals and pay all costs and fees.

B. Unless the Specifications state "No Substitutions", substitutions will be considered for any specified item.

C. Coordinate safety program with that of the Contractor.

D. Deliver all materials as needed to avoid delaying any Work.

E. Store all materials and equipment on the Project Site in a location approved by the Engineer.

1.08 INTERPRETATION OF DRAWINGS

A. Listing of Contract Drawings does not limit responsibility of determining full extent of Work required by Contract Documents. Refer to Architectural, Plumbing, Electrical, Structural and other Contract Drawings and other sections that indicate types of construction in which Work shall be installed.

B. 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 Contract Drawings or Specifications or both, carries with it the instruction to provide the item, regardless of whether or not this instruction is explicitly stated as part of the indication or description.

C. Item referred to in singular number in Contract Drawings shall be provided in quantities necessary to complete Work.

D. Contract Drawings are diagrammatic. They are not intended to be absolutely precise; they are not intended to specify or to show every offset, fitting and component. The purpose of the Contract Drawings is to indicate a systems concept, the main components of the system, and the approximate geometrical relationships, the Contractor shall provide all other components and materials necessary to make the systems fully complete and operational.

E. Information and components shown on riser diagrams but not shown on the Contract Drawings and vice versa, shall be provided as if expressly required on both.

F. If the required material, installation or Work can be interpreted differently from drawing to drawing, or between Contract Drawings and Specifications, the Contractor shall provide that material, installation, or Work which is of the higher standard.

G. Data that may be furnished electronically by the Engineer (on computer tape, diskette, or otherwise) is diagrammatic. Such electronically furnished information is subject to the same limitation of precision as heretofore described. If furnished, such data is for convenience and generalized reference, and shall not substitute for Engineer's sealed or stamped construction documents.

1.09 MODIFICATIONS IN LAYOUT

A. HVAC, Plumbing, and Electrical 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 and to meet Architectural requirements.

B. In all spaces, prior to installation of visible material and equipment, including access panels, review Architectural Drawings for exact locations and where not definitely indicated, request information from the Engineer.

C. Check Contract Drawings as well as Shop Drawings of all trades to verify and coordinate spaces in which Work of this section will be installed.

D. Maintain maximum headroom at all locations. All piping and associated components to be as tight to underside of structure as possible.

E. Make reasonable modifications in layout and components needed to prevent conflict with Work of other trades and to coordinate as specified herein. Systems shall be run in a rectilinear fashion.

F. Where conflicts or potential conflicts exist and engineering guidance is desired, submit sketch of proposed resolution to the Engineer for review and approval.

1.10 RECORD DRAWINGS

A. Refer to SECTION 01700, CONTRACT CLOSEOUT for record drawing requirements.

B. As Work progresses and for duration of Contract, maintain complete and separate set of prints of Contract Drawings at Project Site at all times. Record Work completed and all changes from original Contract Drawings clearly and accurately including Work installed as a modification or addition to the original design.

C. At Completion of Work prepare a complete set of reproducible record drawings.

D. The Engineer will not certify the accuracy of the record drawings; this is the sole responsibility of the Contractor.

E. Submit the record set for approval by the building department in a form acceptable to the department, when required by jurisdiction.

F. Record drawings shall show record condition of details and corrections to schedules. Schedules shall show actual manufacturer and make and model numbers of final equipment installation.

1.11 MATERIAL LIST

A. Within 4 weeks of Award of Contract, the Contractor shall submit a “Plumbing Equipment and Material List”.

B. The list shall contain all categories of material required with names of intended manufacturers. The list does not replace submittals specified herein.

1.12 WARRANTIES

A. Submit manufacturer's standard replacement warranties for material and equipment furnished under this section. Such warranties shall be in addition to and not in lieu of all liabilities, which the manufacturer and the Contractor may have by law or by provisions of the Contract Documents.

B. All materials, equipment and Work furnished under this section shall be guaranteed against all defects in materials and workmanship for a minimum period of one year commencing with the Date of Substantial Completion. Any failure due to defective material, equipment or workmanship which may develop shall be corrected at no additional expense to the Owner including all damage to areas, materials and other systems resulting from such failures.

C. Guarantee that all elements of each system meet the specified performance requirements as set forth herein or as indicated on the Contract Drawings.

D. Upon receipt of notice from the Owner of the failure of any part of the systems during the guarantee period, the affected parts shall be replaced. Any equipment requiring excessive service shall be considered defective and shall be replaced.

1.13 DELIVERY, STORAGE AND HANDLING

A. Provide in accordance with Section 01600 MATERIALS AND EQUIPMENT.

B. All manufactured materials shall be delivered to the Project Site in original packages or containers bearing the manufacturer's labels and product identification.

C. Protect materials against dampness. Store off floors, under cover, and adequately protected from damage.

D. Deliver products to the Project Site and store and protect same as recommended by the manufacturers.

E. Inspect all Plumbing equipment and materials, upon receipt at the Project Site, for damage and correctness.

1.14 PROTECTION OF WORK AND PROPERTY

A. Care and protect all Work included under this section until it has been tested and accepted.

B. Protect all equipment and materials from damage from all causes including theft. All materials and equipment damaged or stolen shall be repaired or replaced with equal material or equipment.

C. Protect all equipment, outlets and openings with temporary plugs, caps and covers. Protect Work and materials of other trades from damage that might be caused by Work or workmen and make good damage thus caused at no additional cost to the Owner.

1.15 SUPERVISION

A. Supply the service of an experienced and competent supervisor who shall be in charge of the plumbing Work at the Project Site.

1.16 SAFETY PRECAUTIONS

A. Comply with all of the safety requirements of OSHA throughout the entire construction period of the Project.

B. Provide and maintain proper guards for prevention of accidents and any other necessary construction required to secure safety of life and/or property.

1.17 SPARE PARTS

A. Furnish spare parts data for each different item of equipment furnished. The data shall include a complete list of parts and supplies, with current unit prices and source of supply; a list of parts and supplies that are either normally furnished at no extra cost with the purchase of the equipment, or specified hereinafter to be furnished as part of the Contract; and a list of additional items recommended by the manufacturer to assure efficient operation for a period of 180 days at the particular installation. The foregoing shall not relieve the Contractor of any responsibilities under the guarantees specified herein.

1.19 HOISTING, SCAFFOLDING AND PLANKING

A. The Work shall include the furnishing, set-up and maintenance of all derricks, hoisting machinery, scaffolds, staging, planking, ladders, etc. as required for the Work.

1.20 SLEEVES, INSERTS, ANCHOR BOLTS, AND PLATES

A. Be responsible for the location of and the maintaining in proper position all sleeves, inserts and anchor bolts supplied and/or set in place. In the event that failure to do so requires cutting and patching of finished Work, it shall be done at the Contractor's expense without any additional cost to the Owner.

1.21 SUPPLEMENTARY STEEL, CHANNELS AND SUPPORTS

A. Provide all supplementary steel, channels and supports required for the proper installation, mounting and support of all plumbing equipment, piping, etc., required by the Specifications.

B. Supplementary steel and channels shall be firmly connected to building construction in a manner approved by the Engineer.

C. The type and size of the supporting channels and supplementary steel shall be determined by the Contractor and shall be of sufficient strength and size to allow only a minimum deflection in conformance with the manufacturer's requirements for loading.

1.22 CERTIFICATES OF INSPECTION/APPROVAL

A. Furnish upon completion of all Work, certificates of inspections from the manufacturers stating that authorized factory engineers have inspected and tested the operation of their respective equipment and found same to be in satisfactory operating conditions.

1.23 ACCESSIBILITY

A. All Work shall be installed so that parts requiring inspection, operation, maintenance and repair are readily accessible. Minor deviations from the drawings may be made to accomplish this, but changes of substantial magnitude shall not be made prior to written approval from the Engineer.

1.24 DEFINITIONS

A. As used in this section, the following terms are understood to have the following meanings:

1. "Furnish" shall mean purchase and deliver to the project site, complete with every necessary accessory and support.

2. "Install" shall mean unload at the delivery point at the site and perform all Work necessary to establish secure mounting, proper location and operation in the project.

3. "Provide" shall mean furnish and install.

4. "Work" shall mean all labor, materials, equipment, apparatus, controls, accessories, and all other items required for a proper and complete installation.

5. "Piping" shall mean, in addition to pipe or tubing, all fittings, flanges, unions, valves, strainers, drains, hangers and other accessories relative to such piping.

6. "Concealed" shall mean hidden from sight in chases, furred spaces, shafts, embedded in construction or in crawl space.

7. "Exposed" shall mean not installed underground or concealed as defined above.

PART 2 MATERIALS

2.01 WATER PIPE AND FITTINGS

A. Above floor piping shall be Type L copper tubing, ASTM B88, hard tempered, with wrot copper fittings and unions, joints made up with 95/5 tin antimony solder and non-corrosive flux.

B. Under ground and under slab piping shall be Type K copper tubing, soft annealed copper tubing with ANSI B16.18 or ASME B16.22 solder joint fittings. Provide minimum number of joints in buried copper tubing. Joints shall be brazed. Brazing filler metal shall conform to AWS A5.8, Type BAg-5 with AWS Type 3 flux, except Type BCuP-5 or BCuP-6 may be used for brazing copper-to-copper joints. Braze joint fittings shall be specifically designed for brazing.

2.02 WATER METER

A. The water meter shall be in accordance with the requirements of the local water department and provided by the Contractor.

B. The meter shall be the remote reading type with the remote read device mounted in an acceptable location.

C. Shut-off valves shall be installed on both sides of the meter and a strainer shall be installed on the inlet side of the meter after the inlet shut-off valve. Provide bypass per local requirements.

2.03 DRAIN AND WASTE PIPE AND FITTINGS

A. Below grade shall be service weight cast iron soil pipe and fittings, ASTM A74, coated with tar or asphaltum, resilient gasket joints.

A. Above grade shall be service weight cast-iron with no hub joints, except piping two inch or smaller may be schedule 40 galvanized steel with 150 lb. galvanized malleable iron drainage fittings, or type DWV copper with wrot copper drainage fittings.

B. Cleanouts

1. ANSI A112.36.2M; provide threaded bronze cleanout plugs.

2. Floor Cleanouts

a. Provide cast-iron or ductile-iron floor cleanout with anchor flange, adjustable height polished bronze, nickel bronze, stainless steel, or chromium-plated copper alloy rim and scoriated floor plate with "CO" cast in the plate, and countersunk screws for installing floor plate flush with finished floor.

2.04 NATURAL GAS PIPING AND GAS RELIEF VENTS

A. Gas piping 2 inches and smaller shall be Schedule 40 black steel pipe with malleable iron threaded cast fittings ASTM B16.3, Class 150.

B. Gas piping 2-1/2 inches and larger shall be schedule 40 black steel pipe in accordance with ASTM A.53 with butt welding fittings in accordance with ANSI B16.9.

C. Gas piping at equipment shall be provided with additional supports.

D. All Work shall be installed in strict accordance with the Massachusetts State Gas Code.

E. Welders Qualifications (Natural Gas System): Qualifications of the procedure and of the welding operations and welders shall be as specified in American Welding Society, AWS D10.9-80, "Specification for Qualification of Welding Procedures and Welders for Pipe and Tubing"; ANSI B31.1 and ASME Boiler Code, Section 1X. The Contractor shall provide certification in writing that the operator or welder has met the prescribed standard. The Owner reserves the right to radio graphically test a minimum of 5% of the welds.

2.05 HANGERS AND SUPPORTS

A. Pipe hangers shall conform to MSS SP 58 and SP 69. Pipe hangers for piping 4 inch and larger shall have rolls either of the Harvard type or 2 rod type. Pipe hangers for 3 inch pipe and under shall be clevis type. Pipe hangers for pipe less than 2 inch may be 1A band type in lieu of clevis type. Hangers in contact with copper tubing shall be copper plated.

B. All hangers on insulated piping shall be sized to fit the outside of the covering. Provide spacer blocks and 16 gauge galvanized protection shields (12 inches long) at hangers, when pipe is installed.

C. All hanger rods shall be hung from wood frame ceiling structure using wood screws designed for use with threaded rod adapters or through-bolted with double nuts and flat washers.

D. Where support points are required to avoid other Work, provide a system of channels and angles between support points as required. Provide all necessary supports and cross framing. No part of piping, ductwork, equipment, and the building shall be stressed beyond its normal allowable working strength.

E. Gas piping installed on the roof shall be set on rubber pipe supports as manufactured by "The Rubber Triangle Co." or an approved equal.

2.06 SLEEVES

A. Sleeves shall be sized to allow 1/2 inch of annular space between the covering (or bare pipe) and the inside of the sleeve.

B. Pipe penetrations through floors and exterior walls shall be sleeved and sealed using Thunderline Link-Seal wall sleeves and seals or approved equal.

C. In other areas, pack the annular space with non-combustible (as defined by ASTM E136) fire stopping material, and seal with non-combustible caulking flush with finish surface.

D. Sleeves in concrete construction shall be galvanized steel pipe, except where passing through exterior walls they shall be ductile iron. Sleeves passing through floors shall project 1 inch above the finish floor. Sleeves in frame and dry wall construction shall be 18 gauge galvanized steel sheet metal.

E. Provide escutcheons at all exposed pipe penetrations in finished areas. Escutcheons shall be chrome plated, sized to cover the sleeve, with set screw.

2.07 PLUMBING SPECIALTIES

A. Pressure reducing valves shall be Watts, U5BLP (or 223 SB) with integral removable stainless steel strainer, nickel alloy seat, and bronze body. Provide a 0-100 psi pressure gauge immediately downstream of the valve.

B. Relief valves (for hot water heaters) shall be combination pressure/temperature relief valves, AGA rated and ASME labeled.

D. Reduced pressure backflow preventers shall be Watts Series 909, Hersey Beeco, ITT Lawlor, or approved equal bronze body reduced pressure zone back flow type, 175 psi maximum working pressure, complete with replaceable seats, strainer, test cocks, shut off valves, union ends, and air gap fitting. Backflow preventers shall be ASSE, AWWA, and FCCCHR or USC approved.

E. Vacuum breakers: Shall be provided in all domestic water heater cold water inlets, in wall hydrant outlets, and in all other locations specified and as directed by the authority having jurisdiction.

F. Water hammer arrestors shall be certified per PDI Standard WH-201 and have stainless steel shell and bellows, 250 psi rated as manufactured by Josam, Zurn, J.R. Smith, or approved equal.

G. Provide dielectric couplings at all ferrous to non-ferrous joints.

H. Pressure gauges shall be ASME B 40.1, liquid filled type, 1% accuracy or better, minimum 2 1/2 inch diameter casing, 0 to 100 psig range, with ball valve shutoff and snubber.

2.08 VALVES

A. Gate Valves 2 inch and Smaller: MSS SP-80, Class 125, with bronze body and integral bronze seat, rising stem, screwed bonnet, solid wedge disk, and threaded ends as manufactured by Jenkins, Crane, Stockham, or approved equal.

B. Ball Valves 2 inch and Smaller: MSS SP-110, 150 psi WSP, with 2 piece bronze body, PTFE seats and seals, full port, blowout proof pressure retaining stem, threaded ends, and vinyl covered carbon steel quarter-turn lever handle. Provide stainless steel ball and stem, with stem extension to accommodate thickness of pipe insulation.

C. Check Valves 2 inch and Smaller: MSS SP-80, Class 150, with bronze body, swing check, thread-in cap, and threaded ends, designed for horizontal or vertical mounting.

2.09 MIXING VALVE

A. Mixing valves shall be of lead free brass body constructions with thermal actuator, adjustable temperature selection with lock down, union connections, integral checks and screens. Provide Powers model LFLM490 or approved equal by Symmons or Lawler.

2.10 PLUMBING FIXTURES

A Water Closet (P-1)

1. Sloan, Toto, American Standard, or approved equal.

   a. Fixture: Sloan model WETS-8029.8010, elongated, floor mount, vitreous china, 1.28 gallon per flush pressure assist tank type.
   b. Flush: Flush Mate 504. 1.28 gpf Minimum static pressure 25 psig.
   c. Seat: Church

B. Lavatory (P-2)

1. Elkay, Toto, American Standard or approved equal.

   a. Fixture: Elkay model ELVW02219, ADA compliant, 22inch x 19 inch wall hung, stainless steel.
   b. Faucet: Elkay LK800GN08T4-ISM 1.5 gpm.
   c. Offset Drain: Elkay off set drain.
   d. Supports: Jay R Smith series 0700 concealed arms.
   e. Miscellaneous: Stops, supplies, p-trap and handicap insulators.

C. Nonfreeze Wall Hydrant (WH-1)

1. ASSE 1019, cast bronze, with lockshield and handwheel, ¾" male IPS inlet, 0.75 inch external hose thread outlet with automatic draining vacuum breaker. Hydrant shall be of sufficient length to extend through walls and place the valve seat inside the building. Bonnet and valve stem shall be removable from outside of the

building. Wall hydrant shall be installed so that water can drain to the exterior when valve is closed.

2.11 FLOOR DRAINS AND ELECTRONIC TRAP PRIMERS

A. General: Floor drains shall be Froet, Jay R. Smith, Josam, Zurn, or approved equal. Manufacturer's catalog numbers specified herein for drains are intended only as a guide for the type and quality to be furnished under this Section of the Specifications.

1. Floor Drain "A" (FD "A" Finished Areas) shall be equal to Jay R. Smith Figure #2005Y-A-B-P050 with sediment bucket and trap primer connection.

2. Floor Drain "B" (FD "B" Mechanical Rooms) shall be equal to Jay R. Smith Figure #2130-B-U-PB-P with sediment bucket, trap primer connection and ductile iron grate.

B. General: Electronic trap primers shall be PPP Inc, Zurn, Sioux Chief, or approved equal. Manufacturer’s catalog numbers specified herein for trap primers are intended only as a guide for the type and quality to be furnished under this Section of the Specifications.

1. Electronic Trap Primer (ETP) shall be equal to PPP Inc MPB-500-115V mini-prime electronic trap priming manifold with box, 120V, single phase, integral stainless steel screen, solenoid valve, 1 inch air gap, and ½ inch inlet and outlet. Install per manufacturer’s requirements and recommendations.

2.12 PIPING INSULATION

A. General

1. The pipe covering specified herein for piping system shall be provided to strict accordance with the manufacturer's printed instructions, the best practice of the trade and to the full intent of this Specification.

2. Flame/Smoke Ratings: Provide complete fibrous glass pipe insulation (insulation, jackets, coverings, sealers, mastics and adhesives) with flame spread index of 25 or less, and smoke developed index of 50 or less, as tested by ASTM E 84 (NFPA 255) method.

3. Manufacturer: Subject to compliance with requirements, provide products of Armstrong World Industries, Inc., Knauf Fiber-Glass, Owens Corning or approved equal.

4. Apply insulation after systems have been tested, proved tight and approved by Architect. Remove dirt, scale, oil, rust and foreign matter prior to installation of insulation.

5. No leaks in vapor barrier or voids in insulation will be accepted.

6. Insulation and vapor barrier on piping which passes through walls or partitions

shall pass continuously through sleeve, except that piping between floors and through fire walls or smoke partitions shall have space allowed for application of approved packing between sleeves and ping, to provide firestop as required by NFPA. Seal ends to provide continuous vapor barrier where insulation is interrupted.

B. Interior Cold, Hot Water, and Non-Potable Water Systems:

1. 1 inch thickness fiberglass piping insulation (hot water pipe size up to 1½ inch)

2. 1½ inch thickness fiberglass piping insulation (hot water pipe size 2 inch and above)

a. ASTM E-547, Class I

3. Fire retardant foil face jackets for ping insulation: ASTM C-921, Type I for piping with temperatures below ambient, Type II for piping with temperatures above ambient. Type I may be used for all piping at installation option.

4. Encase piping fittings insulation with one piece premolded PVC fitting covers, fastened as per manufacturer's recommendations.

5. Staples, Bands, Wires, and Cement: As recommended by insulation manufacturer for applications indicated.

2.13 ELECTRIC WATER HEATER

A. Electric water heater shall be as manufactured by Eemax, Bosch or approved equal.

B. EWH-1: Water heater shall be model EX4208T, manufactured by Eemax, having electrical input of 4.1 KW, 208V, 1 phase and a delivery rate of 0.5 gpm at a 56°F temperature rise. Heater shall be Low Activation type capable of sensing and operation at 0.3 gpm flow rate. Outlet temperature setpoint shall be 110 deg F. Water heater shall have be UL/IAPMO/UPC/ETL listed. Heater shall have working pressure rating of 150 psi, and shall be completely assembled. Water heater shall consist of a rugged steel housing, plastic element assembly, nichrome coils, digital microprocessor control, temperature adjustment knob, and 1/2-inch mpt connections.

PART 3 EXECUTION

3.01 CUTTING AND PATCHING

A. Do all cutting and patching required for the Work. Concrete cutting shall be done with abrasive wheels or saws, and coring with a diamond core bit. The use of jackhammers is prohibited.

3.03 INSTALLATION OF EQUIPMENT

A. Equipment shall be installed in strict accordance with manufacturer's instructions, unless otherwise specified herein, or on the Contract Drawings. In case of discrepancies, contact the Engineer for instructions.

3.04 INSTALLATION OF PIPING

A. Provide a shutoff valve on each pressure piping connection at each item of equipment, except vent and overflow connections.

B. Provide a drain connection at each reduced pressure backflow preventer air gap to receive the discharge from the backflow preventer and convey it to the sanitary drain system.

C. Do not install valves with the stem below horizontal.

D. Provide a union or flange at each connection at each item of equipment.

E. Install piping parallel to or perpendicular to the lines of the building.

F. Pitch all pressurized water piping up 1 inch in 80 feet, or run dead level and provide an air vent every 40 feet.

3.05 TESTS

A. Test water piping at 100 psi hydrostatic pressure before any covering is installed. Blank off or remove items which may be damaged by the test pressure. Correct all defects and retest as many times as is necessary to verify that all defects have been remedied. Neither peening nor the use of leak seals is permitted.

B. Test drain-waste piping by tightly plugging all openings except for the highest opening in the system. Fill all systems to overflowing. Systems shall be tight throughout with no drop in water level for a minimum period of 2 hours.

3.06 DISINFECTION, CLEANING AND ADJUSTING

A. Disinfection

1. Each potable water system (cold and hot water) shall be cleaned and disinfected by the Contractor. Cleaning and disinfection shall be performed after all pipes, valves, fixtures and other components of the systems are installed, tested and ready for operation.

2. All hot and cold water piping shall be thoroughly flushed with clean potable water, prior to disinfection, to remove dirt and other contaminants. Screens of faucets shall be removed before flushing and re-installed after completion of disinfection.

3. Provide pipe flushing report to Owner within one week of completion of flushing.

4. Disinfection shall be done using sodium hypochlorite in the following manner:

a. A service cock shall be provided and located at the water service entrance. The disinfecting agent shall be injected into and through the system from this cock only.

b. The disinfecting agent shall be injected by a proportioning pump or device through the service cock slowly and continuously at an even rate. During disinfection, flow of disinfecting agent into main water supply is not permitted.

c. All sectional valves shall be opened during disinfection. All outlets shall be fully opened at least twice during injection and the residual checked with orthotolidin solution.

d. When the chlorine residual concentration, calculated on the volume of water the piping will contain indicated not less than 50 ppm (parts per million) at all outlets, then all valves shall be closed and secured.

e. The residual chlorine shall be retained in the piping systems for a period of not less than 24 hours.

f. After the retention, the residual shall be not less than five parts per million. If less, then the process shall be repeated as described above.

g. If satisfactory, then all fixtures shall be flushed with clean potable water until residual chlorine by orthotolidin tests shall be not greater than the incoming water supply. (This may be zero.)

5. All Work and certification of performance shall be performed by approved applicators or qualified personnel with chemical and laboratory experience. Certification of performance shall indicate:

a. Name and location of the job and date when disinfection was performed.

b. Material used for disinfection.

c. Retention period of disinfectant in piping system.

d. ppm chlorine during retention.

e. ppm chlorine after flushing.

f. Statement that disinfection was performed as specified.

g. Signature and address of company or person performing disinfection.

6. Upon completion of final flushing (after retention period) the Contractor shall obtain a minimum of one water sample from each hot and cold water line and submit samples to a State-approved laboratory. Samples shall be taken from

faucets located at highest floor and furthest from meter or main water supply. The laboratory report shall show the following:

a. Name and address of approved laboratory testing the samples.

b. Name and location of job and date the samples were obtained.

c. The coliform organism count. (An acceptable test shall show the absence of coliform organisms.)

c. The heterotrophic plate count (HPC). (An acceptable test shall show less than 500 CFU/ml.)

7. If analysis does not satisfy the above minimum requirements, the disinfection procedure shall be repeated.

8. Before acceptance of the systems, the Contractor shall submit to the Owner for review, three (3) copies of Certification of Performance as specified above.

9. Under no circumstances shall the Contractor permit the use of any portion of domestic water systems until properly disinfected, flushed and certified.

B. Cleaning and Adjusting

1. At the completion of the Work, all parts of the installation shall be thoroughly cleaned. All equipment, pipe, valves and fittings shall be cleaned of grease, metal cuttings and sludge which may have accumulated by operation of the system for testing.

2 Any stoppage or discoloration or other damage to parts of the building, its finish, or furnishings due to the Contractor's failure to properly clean the piping system shall be repaired by the Contractor at no additional cost to the Owner.

3. At the completion of the Work, all water systems shall be adjusted for quiet operation.

4. All automatic control devices shall be adjusted for proper operation.

5. All plumbing fixtures and exposed metal work shall be cleaned and polished. Floor drain strainers and traps shall be cleaned of all debris.

6. All items of equipment shall be thoroughly inspected. Any items dented, scratched or otherwise damaged in any manner shall be replaced or repaired and painted to match the original finish. All items so repaired and refinished shall be brought to the attention of the Owner for inspection and approval.

3.07 PAINTING

A. Clean all surfaces free of dirt, oil, grease, etc. Surfaces shall be clean and dry before any paint is applied.

B. Restore to original condition and appearance any equipment which has sustained damage to the manufacturer's prime and/or finish coat.

3.08 OPERATING AND MAINTENANCE MANUALS

A. Furnish to the Owner operations and maintenance instructions of all mechanical, electrical and manually operated equipment furnished and/or installed under the Contract, as specified. See SECTION 01730, OPERATION AND MAINTENANCE MANUALS.

END OF SECTION

SECTION 15500

HEATING, VENTILATION AND AIR CONDITIONING (HVAC)

PART 1 - GENERAL

1.01 DESCRIPTION

A. The Work of this section includes all labor, tools, material, fittings, accessories and equipment necessary to provide the heating, ventilating and air conditioning systems, complete and operable.

B. The Work includes, without limiting the generality thereof:

1. Demolition of existing boiler, stack, piping, hangers, insulation, unit heaters, toilet exhaust fan, ductwork and controls.
2. Demolition of existing Fuel Oil Tank, piping, Generator intake, Generator muffler, and controls.
3. Packaged Rooftop Unit and Controls
4. Ceiling Exhaust Fan
5. Supply, return and exhaust ventilation ductwork.
6. Testing, adjusting and balancing.
7. Standalone Temperature Controls

1.02 SUBMITTALS

A. Submit the following in accordance with Section 01300:

1. Packaged Rooftop Unit and Controls
2. Ceiling Exhaust Fan
3. Ductwork
4. Ductwork accessories
5. Insulation
6. Standalone Temperature Controls

1.03 RELATED WORK SPECIFIED ELSEWHERE

A. Section 05500, Metal Fabrications
B. Section 09900, Painting

1.04 DESIGN CRITERIA

A. The Work of this section shall comply with the requirements of the Massachusetts State Building Code and of all other authorities having jurisdiction.

B. The equipment covered by the Specifications is intended to be standard equipment of proven quality as manufactured by reputable concerns. Equipment shall be designed, constructed and installed in accordance with the best practice of the industry and shall

operate satisfactorily when installed in accordance with the Contract Documents. The Specifications call attention to certain details, but do not purport to cover all details entering into the construction of the equipment.

C. All material shall be new and shall bear the manufacturer's full identification.

D. Requirements of Regulatory Agencies

1. The final, complete installation shall comply with all state and local statutory requirements having jurisdiction. Arrange for all necessary permits, pay all fees and arrange for all required inspections by state and local authorities.

2. In general, all Work shall comply with the requirements of rules, regulations, standards, codes, ordinances, and laws of local, state, and federal governments, and other authorities that have legal jurisdiction over the Project Site. Materials and equipment shall be manufactured, installed and tested as specified in latest editions of applicable publications, standards, rulings and determinations of:

   a. Local and state building, HVAC, plumbing, mechanical, energy conservation, electrical, fire and health department codes.

   b. National Fire Protection Association (NFPA).

   c. Occupational Safety and Health Act (OSHA).

   d. Underwriters' Laboratories (UL).

   e. Material and equipment shall be listed by Underwriters' Laboratories (UL), and approved by ASME for intended service.

3. When requirements cited in the Specifications conflict with each other or with Contract Documents, most stringent shall govern Work.

4. Most recent editions of applicable specifications and publications of the following organizations form part of Contract Documents:

   a. American National Standards Institute (ANSI).

   b. American Society of Mechanical Engineers (ASME).

   c. National Electric Manufacturers Association (NEMA).

   d. American Society for Testing and Materials (ASTM).

   e. American Society for Heating, Refrigerating and Air Conditioning Engineers (ASHRAE).

   f. Air Moving and Conditioning Association (AMCA).

g. Sheet Metal and Air Conditioning Contractors National Association (SMACNA).

h. Thermal Insulation Manufacturers Association (TIMA).

i. Institute of Electrical and Electronics Engineers (IEEE).

j. Insulated Cable Engineers Association (ICEA).

E. Tests, Adjusting and Balancing

1. Test all systems furnished under this section and repair or replace all defective Work. Make all necessary adjustments to the systems and instruct the Owner's personnel in the proper operation of all systems.

2. Defined to include, but not necessarily limited to, air distribution systems, and associated equipment and apparatus of mechanical Work. Work consists of setting speed and volume (flow) adjusting facilities provided for systems, recording data, conducting tests, preparing and submitting reports, and recommending modifications to Work as required by the Contract Documents.

3. Startup the following pieces of equipment in strict accordance with manufacturer instructions and with the manufacturer’s representative.

a. Packaged Rooftop Unit and Controls

4. Submit certified test reports signed by test and balance supervisor performing TAB Work.

5. Include identification and types of instruments used and most recent calibration date with submission of final test report.

6. Shop Drawings

a. Submit sample test data forms complete with certifying agency logo, identifying required test data, date, page number, system designation, system location, Project name, and balancer's name.

7. Tester's Qualifications: Firm with at least 3 years successful testing, adjusting, and balancing experience on projects with testing and balancing requirements similar to those required for the Project, not installer of system to be tested, and otherwise independent of the Project.

8. NEBB or AABC Compliance: Comply with either National Environmental Balancing Bureau (NEBB) or Associated Air Balance Council (AABC) Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems, as applicable to mechanical air distribution systems and associated equipment and apparatus.

9. Industry Standards: Comply with ASHRAE recommendations pertaining to measurements, instruments, and testing, adjusting, and balancing except as otherwise indicated.

10. Do not proceed with testing, adjusting, and balancing Work until each system is complete and operable. Ensure no later residual Work still to be completed.

11. Do not proceed until Work scheduled for testing, adjusting, and balancing is clean and free from debris, dirt, and discarded building materials.

12. The Engineer shall be immediately notified of any unfavorable test results or indication of faulty equipment. No piece of equipment shall be energized until the test data is evaluated and the equipment is proven acceptable.

13. Upon completion of the Work herein described, the Testing Firm shall submit Test and Inspection Reports to the Engineer.

14. If the test and inspection data submitted should indicate deficiencies in the operation of the electrical apparatus or in the manufacturer thereof, promptly implement the necessary adjustments, corrections, modifications and/or replacements necessary to be made to meet the specified requirements.

15. Upon completion of the remedial Work, the Testing Firm shall repeat all of the tests on components previously found deficient on the first test or any additional test if they be required. Have all remedial Work accomplished as may be required by second and/or additional tests.

1.05 DELIVERY, STORAGE AND HANDLING

A. Provide in accordance with Section 01600.

B. All materials and equipment shall be shipped, stored, handled and installed in such manner as not to degrade quality, serviceability, or appearance.

C. Protect all Work, the Owner's property and the property of others from injury or loss caused by operations associated with the Work of this section. Make good any such injury or loss, at no cost to the party suffering the injury or loss.

1.06 PROCEDURE

A. Secure all required permits, inspections, and approvals and pay all costs and fees.

B. Unless the Specifications state "No Substitutions", substitutions will be considered for any specified item.

C. Perform all Work with the Contractor’s safety program.

D. Deliver all materials as needed to avoid delays.

1.07 INTERPRETATION OF DRAWINGS

A. Listing of Drawings does not limit responsibility of determining full extent of Work required by the Contract Documents. Refer to Architectural, HVAC, Electrical, Structural, and other Contract Drawings and other sections that indicate types of construction in which Work shall be installed and Work of other trades with which Work of this section must be coordinated.

B. Except where modified by a specific notation to the contrary, the indication and/or description of any item, in the Contract Drawings or Specifications or both, carries with it the instruction to provide the item, regardless of whether or not this instruction is explicitly stated as part of the indication or description.

C. Items referred to in singular number in Contract Documents shall be provided in quantities necessary to complete Work.

D. Drawings are diagrammatic. They are not intended to be absolutely precise; they are not intended to specify or to show every offset, fitting, and component. The purpose of the Contract Drawings is to indicate a systems concept, the main components of the systems, and the approximate geometrical relationships. Based on the system's concept, the main components, and the approximate geometrical relationships, the Contractor shall provide all other components and materials necessary to make the systems fully complete and operational.

E. If the required material, installation, or Work can be interpreted differently from drawing to drawing, or between Contract Drawings and Specifications, the Contractor shall provide that material, installation, or Work which is of the higher standard.

1.08 MODIFICATIONS IN LAYOUT

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.

B. Check Contract Drawings and Shop Drawings to verify and coordinate spaces in which Work of this section will be installed.

C. Maintain maximum headroom at all locations. All piping, duct, and associated components to be as tight to underside of structure as possible.

1.09 RECORD DRAWINGS

A. Record drawings shall be provided under this Section in accordance with Section 01780 and as specified herein.

B. As Work progresses and for duration of the Contract, maintain complete and separate set of prints of Contract Drawings at the Project Site at all times. Record Work completed and all changes from original Contract Drawings clearly and accurately including Work installed as a modification or addition to the original design.

C. Drawings shall show record condition of details, sections, control changes and corrections to schedules. Schedules shall show actual manufacturer and make and model numbers of final equipment installation.

1.10 MANUFACTURER'S SERVICES

A. Provide manufacturer's services for testing, training and start-up of the following equipment:

1. Packaged Rooftop Unit and Controls.

B. The time required for each system shall be as specified in this section. The time specified shall be used as directed by the Engineer and shall not be used by the manufacturer or Contractor for field adjustments due to manufacturing or shipping defects.

1.11 ELECTRICAL WORK

A. All electrical apparatus and controls furnished as a part of the Work of this section shall conform to applicable requirements under DIVISION 16 - ELECTRICAL. Enclosure types shall be as indicated on the Contract Drawings.

B. All motors shall be furnished by the manufacturer of the equipment served and shall be mounted and aligned so as to run free and true. Each motor shall be built to conform to the latest applicable NEMA, ANSI and IEEE standards for the type and duty of service it is to perform.

C. Each motor shall be designed to operate on 60 Hz., and each shall be expressly wound for the voltage specified. Each motor shall operate successfully as rated load and frequency with a voltage variation of plus or minus 10% of voltage specified.

D. All motors shall be provided with adequate starting and protective equipment as specified, and each shall have a terminal box of adequate size to accommodate the required conduit and wires.

E. All electrical apparatus furnished under this section shall be approved by UL and shall be labeled or listed where such is applicable.

1.12 WARRANTIES

A. Submit manufacturer's standard replacement warranties for material and equipment furnished under this section. Such warranties shall be in addition to and not in lieu of all liabilities, which the manufacturer and the Contractor may have by law or by provisions of the Contract Documents, including Articles 6 and 13 of the Standard General Conditions.

B. Guarantee that all elements of each system meet the specified performance requirements as set forth herein or as indicated on the Contract Drawings.

C. Upon receipt of notice from the Owner of the failure of any part of the systems during the guarantee period, the affected parts shall be replaced. Any equipment requiring excessive service shall be considered defective and shall be placed.

1.13 DELIVERY, STORAGE AND HANDLING

A. Provide in accordance with Section 01610 and as specified herein.

B. All manufactured materials shall be delivered to the Project Site in original packages or containers bearing the manufacturer's labels and product identification.

C. Protect materials against dampness. Store off floors, under cover, and adequately protected from damage.

D. Deliver products to the Project Site and store and protect same as recommended by the manufacturers.

E. Inspect all HVAC equipment and materials, upon receipt at the Project Site, for damage and correctness.

1.14 PROTECTION OF WORK AND PROPERTY

A. Care and protect for all Work included under this section until it has been tested and accepted.

B. Protect all equipment and materials from damage from all causes including theft. All materials and equipment damaged or stolen shall be repaired or replaced with equal material or equipment.

C. Protect all equipment, outlets and openings with temporary plugs, caps and covers. Protect Work and materials of other trades from damage that might be caused by Work and make good damage thus caused at no additional cost to the Owner.

1.15 SAFETY PRECAUTIONS

A. Comply with all of the safety requirements of OSHA throughout the entire construction period of the Project.

B. Provide and maintain proper guards for prevention of accidents and any other necessary construction required to secure safety of life and/or property.

1.16 SPARE PARTS

A. Furnish spare-parts data for every component that is required to be maintained for normal service of equipment furnished. The data shall include a complete list of parts and supplies, with current unit prices and source of supply; a list of parts and supplies that are either normally furnished at no extra cost with the purchase of the equipment, or specified hereinafter to be furnished as part of the Contract; and a list of additional items recommended by the manufacturer to assure efficient operation for a period of 180 days at

the particular installation. The foregoing shall not relieve the Contractor of any responsibilities under the guarantees specified herein.

1.17 HOISTING, SCAFFOLDING AND PLANKING

A. The Work to be done under this section of the Specifications shall include the furnishing, set-up and maintenance of all derricks, hoisting machinery, scaffolds, staging, planking, ladders, etc. as required for the Work.

1.18 SLEEVES, INSERTS, ANCHOR BOLTS, AND PLATES

A. Be responsible for the location of and the maintaining in proper position all sleeves, inserts and anchor bolts supplied and/or set in place. In the event that failure to do so requires cutting and patching of finished Work, it shall be done at the Contractor's expense without any additional cost to the Owner.

1.19 SUPPLEMENTARY STEEL, CHANNELS AND SUPPORTS

A. Provide all supplementary steel, channels and supports required for the proper installation, mounting and support of all HVAC equipment, piping, etc., required by the Specifications.

B. Supplementary steel and channels shall be firmly connected to building construction in a manner approved by the Engineer.

C. The type and size of the supporting channels and supplementary steel shall be determined by the Contractor and shall be of sufficient strength and size to allow only a minimum deflection in conformance with the manufacturer's requirements for loading.

D. All steel used for supplementary steel, channels and supports shall be 316 stainless steel.

1.20 CERTIFICATES OF INSPECTION/APPROVAL

A. Furnish upon completion of all Work, certificates of inspections from the manufacturers stating that authorized factory engineers have inspected and tested the operation of their respective equipment and found same to be in satisfactory operating conditions.

1.21 ACCESSIBILITY

A. All Work shall be installed so that parts requiring inspection, operation, maintenance and repair are readily accessible. Minor deviations from the Contract Drawings may be made to accomplish this, but changes of substantial magnitude shall not be made prior to receipt of written approval from the Engineer.

1.22 DEFINITIONS

A. As used in this section, the following terms are understood to have the following meanings:

1. "Furnish" shall mean purchase and deliver to the project site, complete with every necessary accessory and support.

2. "Install" shall mean unload at the delivery point at the site and perform all Work necessary to establish secure mounting, proper location and operation in the project.

3. "Provide" shall mean furnish and install.

4. "Work" shall mean all labor, materials, equipment, apparatus,, controls, accessories, and all other items required for a proper and complete installation.

5. "Piping" shall mean, in addition to pipe or tubing, all fittings, flanges, unions, valves, strainers, drains, hangers and other accessories relative to such piping.

6. "Concealed" shall mean hidden from sight in chases, furred spaces, shafts, embedded in construction or in crawl space.

7. "Exposed" shall mean not installed underground or concealed as defined above.

PART 2 - MATERIALS

2.01 PIPE AND FITTINGS

A. Condensate drain piping shall be Type 1, Grade 1, Class 12454-B, Schedule 40 polyvinyl chloride (PVC) pipe conforming to ASTM D-1785. Drain piping shall have Schedule 40 PVC socket fittings conforming to ASTM D-2466. All joints between pipe and fittings shall be solvent cemented joints conforming to ASTM D-2235 and ASTM D-402. Provide protection for PVC piping exposed to weather from ultraviolet radiation.

2.02 HANGERS AND SUPPORTS

A. All hangers and supports shall be electroplated steel.

B. Pipe hangers shall conform to MSS SP 58 and SP 69. Pipe hangers for piping 4 inch and larger shall have rolls either of the Harvard type or 2 rod type. Pipe hangers for 3 inch pipe and under shall be clevis type. Pipe hangers for pipe less than 2 inch may be 1A band type in lieu of clevis type. Hangers in contact with copper tubing shall be copper plated.

C. All hangers on insulated piping shall be sized to fit the outside of the covering. Provide spacer blocks and 16 gauge SS protection shields (12 inches long) at hangers, when pipe is installed.

D. Duct hangers shall be in accordance with the "HVAC Duct Construction Standards" published by the Sheet Metal and Air Conditioning Contractors National Association, Incorporated (SMACNA).

E. Where support points are required to avoid other Work, provide a system of channels and angles between support points as required. Provide all necessary supports and cross framing. No part of piping, ductwork, equipment, and the building shall be stressed beyond its normal allowable working strength.

2.03 UNIONS

A. Unions for PVC pipe 2 inch and smaller shall be Schedule 40 PVC.

2.04 PIPING SPECIALTIES

A. Provide dielectric couplings or flanges in all copper to ferrous transitions.

B. Sleeves

1. Provide sleeves at all penetrations. Sleeves shall be aluminum or 316 stainless steel except in concrete as noted below. Sleeves shall be sized to allow 1/2 inch of annular space between the covering (or bare pipe) and the inside of the sleeve.

2. Sleeves in concrete construction shall be 316L steel pipe, except where passing through exterior walls and slabs-on-grade they shall be ductile iron. Sleeves passing through floors shall project two inches above the finish floor and sleeves passing through walls shall be trimmed flush with the wall surface.

2.05 PACKAGED ROOFTOP UNIT

A. Provide an outdoor roof - mounted, gas-fired DX cooled Air Handler Unit System and Controls as manufactured by Daikin, York, LG, or equal. Capacity and performance shall be as scheduled. The unit shall include supply air and exhaust air fans, motors with starters and relays, air filters, gas burner section, DX evaporator and condenser cooling section, 100% economizer section and specified options and controls.

B. Provide a prefabricated 14-inch-high roof curb assembly.

C. References

1.	SMACNA	HVAC Duct Construction Standards—Metal and Flexible
2.	AHRI 360	Standard for Performance Rating of Commercial and Industrial Unitary Air-Conditioning and Heat Pump Equipment
3.	UL 1995	Heating and Cooling Equipment
4.	ASHRAE 62.1	Ventilation for Acceptable Indoor Air Quality

D. Service for the unit shall be available locally either directly from the manufacturer or from the manufacturer's certified local representative. Provide two hours of on-site startup service and instruction.

E. Submittals

1. Drawings shall include accurately scaled CAD drawings of the entire unit with plan and elevation views and any required sub section or component thereof. Drawings shall be made available in electronic format either electronically or on disk.

2. Product performance data shall include unit dimensions, weights, capacities, component performance data, electrical data, construction details, required clearances and service access dimensions, field connection requirements and data, static pressure drops, methods of vibration isolation, included gages, performance data for each blower, and unit surface material and finish.

3. The submittal shall provide information on filters including pressure drop, efficiency, media description, frame details, and filter gage information.

4. Submittal shall include electrical data for the unit including full load amps for each unit component, maximum circuit ampacity, breaker and disconnect size, transformer size, and wiring diagrams for control panel wiring and unit component wiring that indicates factory and field installed wiring.

5. Submittal shall include the manufacturers recommended installation instructions.

F. Construction

1. Unit shall have an all-welded base frame constructed from steel. Base shall overhang the roof curb for positive water runoff and shall seat on the roof curb gasket to provide a positive, weather tight seal. The frame shall include formed supports constructed from welded structural steel under blowers and other components.

2. A galvanized steel interior floor shall be installed on the base frame. The floor shall be insulated. Floor insulation shall be 1" thick minimum and consist of a load-bearing, rigid, closed-cell foam core laminated to a reinforced mat facer.

3. All cabinet walls, access doors, floor and roof shall be fabricated of double wall, impact resistant, panels insulated with fiberglass or foam.

4. Cabinet frame exterior shall be of formed 18 gauge (minimum) galvanized steel. Panels (fixed and access) to be of 18-gauge galvanized steel. Frame and panels to have an internal liner of 22 gauge (minimum) galvanized steel or the equivalent in aluminum and be sealed with silicone sealant to provide a complete vapor barrier and non-contaminating surface to all air streams. Unit cabinet shall

be designed to operate at total static pressures up to 5.0 inches w.g. Unit exterior and interior finish shall be painted G90 Galvanized steel.

G. Insulation: Insulation shall have a minimum R-value of 7. Foam insulation shall be tested in accordance with ASTM D-1929 for a minimum flash ignition temperature of 610°F. Insulation shall meet the flame and smoke generation requirements of NFPA-90A.

H. DX Refrigeration System: DX system shall include R410A refrigerant, cooling coil with copper/aluminum fin tube construction, sloped stainless steel drain pan, condensate drain connection, fully modulating hot gas reheat coil, inverter scroll compressor with modulating capacity control, and suction and discharge isolation valves.

I. Gas Heater

1. Gas heater shall be U.L. and E.T.L. listed.

2. Heater elements shall be stainless steel.

3. Gas burner controls shall include modulating 5:1 turndown.

J. Drive System/Speed Control: The supply and exhaust fan motors shall be premium efficiency direct drive ECM type.

K. Air Filters: Outside and Return air filters shall be MERV 8 when evaluated under the guidelines of ASHRAE Standard 52.2. Initial resistance to airflow shall not exceed 0.1" w.g. at a face velocity of 250 fpm. The filter shall be classified by Underwriters Laboratories as UL Class 2. Filters shall be mounted within unit in galvanized holding frames upstream of exchanger and accessible through access panels or doors

L. Dampers:

1. Actuated Dampers shall have heavy duty extruded aluminum frames, 4" extruded aluminum air-foil blades mounted on brass shafts, supported and inter-connected by fiberglass reinforced nylon gears.

2. Low leakage dampers shall have hollow (thermoplastic elastomer (TPE)) rubber jamb seals built into both the blades and the frame. The side casings shall enclose the gears with ABS plastic covers that also serve as seals in the closed position.

3. Outside Air Shut-Off Dampers: Outside air dampers shall be mounted on the inlet of the unit and operated by a spring return, direct-coupled modulating actuator with an end switch to be interlocked with the supply air motor relay. Damper shall be controlled to provide 0 to 100% economizer operation. Dampers shall have parallel blades.

4. Exhaust Air Shut-Off Dampers: Exhaust air damper shall be mounted on the outlet of the unit and operated by a spring return, direct-coupled modulating actuator with an end switch to be interlocked with the return air motor relay.

Damper shall be controlled to provide 0 to 100% economizer operation. Dampers shall have parallel blades.

5. Spring Return Actuators shall be direct coupled type which require no crankarm and linkage and be capable of direct mounting to the damper jackshaft. The actuators must be designed so that they may be used for either clockwise or counterclockwise fail-safe operation. Actuators shall use a brushless DC motor and be protected from overload at all angles of rotation. Actuators shall have reversing switch and manual override on the cover, and be protected from overload at all angles of rotation. As required, 1 or 2 SPDT auxiliary switches shall be provided having the capability of being adjustable. Actuators with auxiliary switches must be constructed to meet the requirements for Double Insulation so an electrical ground is not required to meet agency listings. Run time shall be constant and independent of torque. Actuators shall be UL listed and CSA certified, have a 5 year warranty, and be manufactured under ISO 9001 International Quality Control Standards.

M. Electrical

1. A single main un-fused disconnect switch for single point power connection shall be provided. The disconnect switch shall be mounted through the access panel so that power will have to be shut-off before the access door can be opened.

2. All wiring and controls shall be factory tested before shipment.

3. The unit wiring diagram shall be provided in the panel.

N. Controls

1. The Packaged Rooftop Unit shall be furnished with the following factory installed controls:

   a. Leaving coil temperature sensor
   b. Duct high limit switch
   c. Duct static pressure sensor
   d. Return air temperature sensor
   e. Discharge air temperature sensor – Wired in unit, mounted in supply duct
   f. Outside air temperature sensor
   g. Return air enthalpy sensor
   h. Outside air enthalpy sensor
   i. Dirty filter on/off switch
   j. Supply fan air proving via modbus
   k. Building static pressure sensor
   l. Ebtron airflow station

2. The Packaged Rooftop Unit shall be furnished with the following controls for installation in the field:

a. Adjustable Wall Mounted Temperature Sensor
b. MicroTech III Unit Controller Remote User Interface

O. Sequence of Operation

The following sequence of control shall be programmed into the controller by the manufacturer at the factory:

1. The unit shall start and run in one of the following modes (selectable by Owner):

   a. Fans shall run continuously until manually shut off.

   b. Fans shall run continuously during occupied periods and shall cycle from the wall mounted temperature sensor during unoccupied periods. The gas heating section, DX coil and economizer sections shall modulate to maintain a space temperature of 68 deg F occupied temperature and 50 deg F unoccupied temperature during the heating season and 78 deg F occupied temperature and 80 deg F unoccupied temperature during the cooling season.

   c. Fans shall cycle from the wall mounted temperature sensor to maintain a space temperature of 68 deg F occupied temperature and 50 deg F unoccupied temperature during the heating season and 78 deg F occupied temperature and 80 deg F unoccupied temperature during the cooling season.

2. During occupied periods, the outdoor air damper shall be set to the minimum outdoor air setting. Upon loss of power or unit shutdown, spring return damper actuators shall close the outdoor air damper and exhaust air damper and shall open the return air damper.

3. The unit's programmable controller shall modulate the economizer, DX coil, and gas heat in sequence to control supply air temperature. Supply air temperature is reset between occupied or unoccupied temperature setpoints by a remote programmable controller.

4. The unit controls shall sense and compare the outdoor air vs the return air enthalpies and shall utilize outdoor air for supply when the outdoor air enthalpy is lower than the return air.

5. When outdoor air is available for economizer cooling, the DX section shall be locked out and outdoor air shall be brought in up to 100% of the supply air flow.

2.06 CEILING EXHAUST FANS

A. Provide ceiling mounted exhaust fan as manufactured by Panasonic, Broan, Greenheck or approved equal. See schedule for fan capacity and performance. Basis of design is Panasonic.

B. Fan shall consist of a metal enclosure, built in backdraft damper, integral duct adapter, ECM motor with thermal cutout, ceiling grille, and centrifugal fan.

2.07 DUCTWORK

A. Provide all sheet metal ductwork required for the various supply and exhaust air systems. Unless otherwise indicated on the Contract Drawings ductwork shall be galvanized steel and all ductwork and sheet metal plenums shall be constructed meeting the requirements of ASTM B 209, lock-forming quality. All ductwork, except where specified otherwise herein, shall be fabricated in accordance with the "HVAC Duct Construction Standards for Metal Ducts" published by the Sheet Metal and Air Conditioning Contractors National Association, Incorporated (SMACNA), 2-inch water gauge Pressure Class.

B. Ducts shall be true to the inside dimensions indicated on the Contract Drawings. Cross break all duct panels over 12 inches wide. Support ducts rigidly and securely. Support horizontal ducts not over 8 feet on center. Ducts shall be straight and smooth on the inside with neatly finished joints and all transverse joints and longitudinal seams of all low-pressure ducts shall be sealed in conformance with SMACNA seal classification B.

C. Elbows narrower than 16 inches shall be full radius elbows with inside radius equal to the dimension of the duct in the plane of the elbow or offset. Elbows wider than 16 inches may be full radius elbows or square elbows with air foil section turning vanes (Duct Manual Figure 2-3) and 6 inch inside radius. Vanes shall be "Runner" Type 2, 3 1/4 inches on centers. Install outside vane flush against the outside of the elbow.

D. Transitions in duct mains and branches shall be made with sides sloping at not more than 1 inch in 7 inches on the side of the transformation for diverging transitions and 1 inch in 4 inches for converging transitions. Transitions in ductwork to pieces of equipment shall be made with a 20 degree maximum angle projected from the straight duct side on a diverging transition and a 30 degree maximum angle projected from the straight duct side on a converging transition. Any conditions requiring deviations from the above shall be brought to the attention of the Engineer for approval.

E. All notches for connecting sections of duct, including longitudinal seam notches, shall not be cut any deeper than 1 7/8 inches to insure tight corners in 2 inch deep slip joints.

F. Slips shall be at least 2 gauges heavier than the duct and all joints shall be made in a neat and workmanlike manner and in all cases shall be tight. All ducts shall have all joints sealed with EC-800 as manufactured by 3M, Hardcast or approved equal.

2.08 DUCTWORK ACCESSORIES

A. Duct Flexible Connections: Provide 6 inch metal edge ventglas or thermafab flexible connections at fan and unit inlets and outlets. Leave 1 inch minimum slack, (this means 1/2 inch standing fold). Duct openings shall be lined up on either side of flexible connections.

B. Wire Mesh Screen: 1/2 inch x 1/2 inch 316 series stainless steel welded wire mesh.

C. Volume Dampers

1. Provide volume dampers where indicated on the Contract Drawings and where noted within the Contract Drawings and these specifications.

2. Dampers less than 12 inches in height shall be equal to Young Regulator manual adjustable rectangular opposed blade dampers.

3. Dampers 12 inch and larger in height shall be opposed multi-blade equal to Greenheck, Nailor, or Vent Products.

4. Damper frame shall be constructed of 316 series stainless steel channel with minimum thickness of .050 inches. Opposed damper blades shall be 316 series stainless steel with minimum thickness of .050 inches and shall include reinforcing ribs. Each blade shall be supported in the damper frame by individual Teflon axle bearings, and shall be driven by stainless steel connecting slide linkage controlled by 3/8 inch square steel control shaft.

5. Damper blades shall be 2 gauges heavier than adjoining ductwork, and shall be riveting to supporting rods. Hem over edges parallel to rods.

6. Brackets shall be galvanized metal, secured to ductwork with sheet metal screw with locking quadrant arms. Provide 2-inch handle extension for all dampers on externally insulated ductwork.

D. Sheet Metal Access Panels

1. Provide access panels of the proper size and at all locations in ductwork necessary to service control devices, fan bearings and as required to service all systems.

2. Access panels shall have foam gasketing, fixed hinges and compression type latches as manufacturered by Ventlock, Duro-Dyne or approved equal. Access doors for insulated ducts shall be insulated with 1-inch think 1 ½ lb density coated duct liner.

E. Diffusers, Registers and Grilles

1. Supply Grille, Supply Register:

   a. Minimum 22 gauge type steel construction.
   b. 1 1/4-inch margins, mitered corners, and countersunk mounting holes.
   c. Double deflection.
   d. Vertical front blades and horizontal rear blades.
   e. Individual adjustable front and rear blades on ¾-inch centers.
   f. Mill finish.
   g. Register to be provided with integral opposed blade type steel damper adjustable from face.

2. Supply Diffuser

a. Aluminum construction.
b. Adjustable pattern vanes on all four sides for horizontal to vertical throw discharge.
c. Spring loaded removable core.
d. White enamel finish.
e. Round neck.
f. Diffuser to be provided with integral opposed blade type steel damper adjustable from face.

3. Exhaust Registers, Exhaust Grilles:

a. Minimum 22 gauge type steel construction.
b. 1 1/4-inch margins, mitered corners, and countersunk mounting holes.
c. Fixed vertical zero deflection bars.
d. Mill finish.
e. Register to be provided with integral opposed blade type steel damper adjustable from face.

F. Control Dampers

1. Damper Assembly: Damper shall conform to SMACNA HVAC Duct Construction Standards. A single damper section shall have blades no longer than 48 inches and shall be no higher than 72 inches. Maximum damper blade width shall be 8 inches. Larger sizes shall consist of a combination of sections. Damper shall be 316 stainless steel. Flat blades shall be made rigid by folding the edges. Provide blades with compressible seals at points of contact. Provide channel frames of dampers with jamb seals to minimize air leakage. Dampers shall not leak in excess of 10 cfm per square foot at 4 inches water gage static pressure when closed. Seals shall be suitable for an operating temperature range of minus 40 degrees F to 200 degrees F. Dampers shall be rated at not less than 2000 fpm air velocity. Moving parts of operating linkage in contact with each other shall consist of dissimilar materials. Damper axles shall be 0.5 inches minimum plated steel rods supported in the damper frame by stainless steel or bronze bearings. Blades mounted vertically shall be supported by non-ferrous dissimilar thrust bearings. Pressure drop through dampers shall not exceed 0.05 inch water gage at 1,000 fpm in the wide-open position. Frames shall not be less than 2 inches wide. Dampers shall be tested in accordance with AMCA 500-D.

2. Spring Return Actuators shall be direct coupled type which require no crankarm and linkage and be capable of direct mounting to the damper jackshaft. The actuators must be designed so that they may be used for either clockwise or counterclockwise fail-safe operation. Actuators shall use a brushless DC motor and be protected from overload at all angles of rotation. Actuators shall have reversing switch and manual override on the cover, and be protected from overload at all angles of rotation. As required, 1 or 2 SPDT auxiliary switches shall be provided having the capability of being adjustable. Actuators with auxiliary switches must be constructed to meet the requirements for Double Insulation so an electrical ground is not required to meet agency listings. Run

time shall be constant and independent of torque. Actuators shall be UL listed and CSA certified, have a 5 year warranty, and be manufactured under ISO 9001 International Quality Control Standards.

2.09 INSULATION

A. All insulation, adhesives, tape, etc. shall conform to NFPA 90A. No voids in insulation will be permitted.

B. Pipe Insulation.

1. Suction lines, hot gas bypass lines, and outdoor liquid lines shall be insulated with 1" thick rigid closed cell foam insulation, AP/Armaflex, Manville, Owens Corning or approved equal.

2. Insulation shall comply with ASTM E84 or UL 723.

3. Insulation shall have a thermal conductivity of 0.245 at 75 deg. F mean temperature and shall have a 25/50 Flame Spread and Smoke Developed Index.

4. Insulation shall include antimicrobial protection for the inhibition of mold and mildew growth.

5. Installation shall meet manufacturer's recommendations. Seal butt joints with insulation manufacturers approved adhesive.

6. Outside above ground insulation shall be protected with two coats of approved vinyl lacquer coating over woven glass mesh adhered to insulation with Insulcolor or approved equal lagging adhesive, as recommended by manufacturer.

C. Duct Insulation

1. Supply ductwork shall be multi-layered from 1" thick, semi rigid fibrous glass boards to provide an aggregate insulation value of R-12. Cover with factory applied fire retardant foil reinforced kraft vapor barrier facing on outer layer. Outdoor ductwork (if applicable) shall be jacketed and insulated to R-12 using semi-rigid fibrous glass boards with fire retardant foil-reinforced vapor barrier and a canvas waterproof jacket with waterproof coating.

2. Insulation density shall be 3 lb./cf with maximum K factor of 0.23 at 75°F mean temperature. Insulation value shall be equal to R-12.

3. Impale insulation on mechanical fasteners applied to duct surface on 12" centers. Use at least two rows of fasteners on each side of duct. Provide fastener rows within 3" of seams and edges. Secure insulation with suitable speed washers or clips firmly embedded in insulation. Provide additional fasteners as necessary on cross broken ducts.

4. Extend insulation to standing seams, reinforcing, and other vertical projections 1" and less; do not carry over. Vapor barrier jacket shall be continuous across seams, reinforcing and projections. Insulation and jacket shall be carried over projections that exceed insulation thickness.

5. Transverse joints shall be butted tightly. Longitudinal joints shall be butted, ship lapped or 45°mitered. Seal joints with 4" wide strips of approved vapor barrier patch material and adhesive, or with approved pressure sensitive vapor barrier tape.

6. Cover breaks, ribs and standing seam penetrations with patch of jacket material no less than 2" beyond break; secure with adhesive and staple. Seal staples and joints with brush coat of vapor barrier coating.

7. Fill voids in insulation at jacket penetrations and seal with vapor barrier coating.

8. Seal and flash terminations and punctures with fibrous glass cloth between two coats of vapor barrier coating.

9. Terminate vapor barrier and extend insulation at standoff brackets.

2.10 AUTOMATIC CONTROLS

A. The Contractor shall furnish, install or provide electric automatic control devices as indicated on the Drawings and in the Specifications.

B. Provide:

1. Automatic damper actuators (if not furnished with equipment).

C. Furnish:

1. Integral Controller for Packaged Rooftop Unit.

2. Wall mounted Temperature Sensor

3. Remote User Interface.

C. Install:

1. All sensors, user interfaces etc. for Packaged Rooftop Unit supplied as field installed devices.

D. Submittals

1. The following shall be submitted for approval:

a. Data sheets for control system components.

E. Instruction and Adjustment

1. Upon Completion of the Work, the Contractor shall:

a. Completely adjust and ready for use: thermostats, controllers, actuators and other components and equipment provided under this section.

b. Furnish operation and maintenance manuals covering function and operation of control systems on project for use by Owner's operating personnel. Competent technician shall be provided for instruction purposes.

c. Provide adequate instruction (not less than 2 hours) to the Owner's personnel by means of a competent technician. Obtain written confirmation from the Owner that adequate instructions for each system has been provided in an acceptable manner.

G. Provide components factory ordered for this Project. Rebuilt equipment, warehoused equipment, or earlier generation equipment shall not be acceptable. Electrical and electronic shall have a NEMA 250 Type 4 enclosure in accordance with NEMA 250 unless otherwise indicated on the Contract Drawings. Actuators shall operate within limit ratings of minus 35 to 150 degrees F.

H. Control Dampers

1. Damper Assembly: Damper shall conform to SMACNA HVAC Duct Construction Standards. A single damper section shall have blades no longer than 48 inches and shall be no higher than 72 inches. Maximum damper blade width shall be 8 inches. Larger sizes shall consist of a combination of sections. Damper shall be 316 stainless steel. Flat blades shall be made rigid by folding the edges. Provide blades with compressible seals at points of contact. Provide channel frames of dampers with jamb seals to minimize air leakage. Dampers shall not leak in excess of 10 cfm per square foot at 4 inches water gage static pressure when closed. Seals shall be suitable for an operating temperature range of minus 40 degrees F to 200 degrees F. Dampers shall be rated at not less than 2000 fpm air velocity. Moving parts of operating linkage in contact with each other shall consist of dissimilar materials. Damper axles shall be 0.5 inches minimum plated steel rods supported in the damper frame by stainless steel or bronze bearings. Blades mounted vertically shall be supported by non-ferrous dissimilar thrust bearings. Pressure drop through dampers shall not exceed 0.05 inch water gage at 1,000 fpm in the wide-open position. Frames shall not be less than 2 inches wide. Dampers shall be tested in accordance with AMCA 500-D.

2. Provide electric spring return actuators. Spring return actuators shall be direct coupled type equal to Belimo which require no crankarm and linkage and be capable of direct mounting to the damper jackshaft. Actuators shall fail to their spring return positions on signal or power failure. Actuators shall have visible position indicators. Actuators shall open or close the devices to which they are applied within 60 seconds after a full scale signal input change. Damper actuators shall be rated for at least 125% of the motive power necessary to operate the

connected damper. The actuator stroke shall be limited by an adjustable stop in the direction of the return stroke. Actuators shall be provided with mounting and connecting hardware. Actuators shall function as required within 85% to 110% of their power supply rating. Actuators shall use a brushless DC motor and be protected from overload at all angles of rotation. Actuators shall have reversing switch and manual override on the cover, and be protected from overload at all angles of rotation. As required, 1 or 2 SPDT auxiliary switches shall be provided having the capability of being adjustable. Actuators shall be UL listed and CSA certified, have a 5-year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Confirm 24VAC actuator voltage with DIVISION16 prior to ordering actuators.

I. Temperature Sensor

1. 24 VAC
2. 0.17 VA maximum
3. 40 - 100°F Temperature Range
4. Daikin Adjustable Space Temperature Sensor 910143408

J. Remote User Interface

1. Daikin MicroTech III Unit Controller

2.11 CONTROL SEQUENCES

A. Control sequences of operation shall be as indicated as follows:

1. Packaged Rooftop Unit: System sequence shall be as described in paragraph 2.05.O above.

2. Ceiling Exhaust Fan shall be controlled by the room light switch.

3.00 PART 3 - EXECUTION

3.01 GENERAL

A. Install all items specified under this section according to the manufacturer's requirements, shop drawings, the details as shown on the Contract Drawings and/or as specified.

B. Install all Work so that parts requiring inspection, replacements, maintenance and repair shall be readily accessible. Minor deviations from the Contract Drawings may be made to accomplish this, but any substantial change shall not be made without prior written approval from the Owner.

C. Equipment bases mounted on concrete slabs and pads, or mounted on stands, gratings, platforms, or other, shall not be set in any manner, except on the finished and permanent support.

D. Support of equipment on studs or other means, and the placing or building of the supporting slab, pad, pier, stand, grating, or other "to the equipment", is prohibited.

E. Concrete supporting structures shall have been constructed and cured a minimum of 14 days before equipment is mounted.

3.02 CUTTING AND PATCHING

A. Do all cutting and patching required except cutting and patching of finish (visible) materials. Concrete cutting shall be done with abrasive wheels or saws, and coring with a diamond core bit. Jackhammers are prohibited.

3.03 CONNECTIONS TO EQUIPMENT

A. Unless otherwise indicated, the size of the connections to each piece of equipment shall be not smaller than the connections on the equipment. No bushed connections shall be permitted. Change in sizes shall be made with reducers or increasers only.

3.04 SUPPORTS

A. General

Hangers used to support piping 2 inches and larger shall be fabricated to permit adequate adjustment after erection while supporting the load.

B. Pipe Hangers and Supports

1. Pipe hangers and supports shall conform to MSS SP-58 and MSS SP-69, except as specified as follows:

a. Types 5, 12, and 26 shall not be used.

b. Type 3 shall not be used on insulated pipe which has a vapor barrier. Type 3 may be used on insulated pipe that does not have a vapor barrier if clamped directly to the pipe and if the clamp bottom does not extend through the insulation and the top clamp attachment does not contact the insulation during pipe movement.

c. Type 19 and 23 C-clamps shall be torqued per MSS SP-69 and have both locknuts and retaining devices, furnished by the manufacturer. Field-fabricated C-clamp bodies or retaining devices are not acceptable.

d. Type 20 attachments used on angles and channels shall be furnished with an added malleable iron heel plate or adapter.

e. Type 24 may be used only on trapeze hanger systems or on fabricated frames.

f. Horizontal pipe supports shall be spaced as specified in MSS SP-69 and a support shall be installed not over 1 foot from the pipe fitting joint at

each change in direction of the piping. Pipe supports shall be spaced not over 5 feet apart at valves.

g. Vertical pipe shall be supported at intervals of not more than 15 feet, except that pipe shall be supported not more than 8 feet from end of risers, and at vent terminations.

h. Except for Type 3, pipe hangers on horizontal insulated pipe shall be the size of the outside diameter of the insulation.

3.06 PIPE EXPANSION

A. The expansion of pipes shall be provided for by changes in the direction of the run of pipe.

3.07 DUCTWORK

A. Installation shall be according to SMACNA HVAC DUCT CONSTRUCTION STANDARDS, latest edition unless otherwise indicated. Duct supports for sheet metal ductwork shall be according to SMACNA HVAC DUCT CONSTRUCTION STANDARDS, latest edition unless otherwise specified. Friction beam clamps indicated in SMACNA HVAC DUCT CONSTRUCTION STANDARDS, latest edition unless otherwise indicated shall not be used. Supports shall be attached only to structural framing members. Supports shall not be anchored to metal decking unless a means is provided and approved for preventing the anchor from puncturing the metal decking. Where supports are required between structural framing members, suitable intermediate metal framing shall be provided. Where C-clamps are used, retainer clips shall be provided.

B. Dust Control: To prevent the accumulation of dust, debris and foreign material during construction, temporary dust control protection shall be provided. The distribution system (supply and return) shall be protected with temporary seal-offs at all inlets and outlets at the end of each day's Work. Temporary protection shall remain in place until system is ready for startup.

C. Power Transmission Components Adjustment: V-belts and sheaves shall be tested for proper alignment and tension prior to operation and after 72 hours of operation at final speed. Belts on drive side shall be uniformly loaded, not bouncing. Alignment of direct driven couplings shall be to within 50 percent of manufacturer's maximum allowable range of misalignment.

3.08 AIR SYSTEMS BALANCING

A. The building shall be essentially complete with final ceiling, walls, windows, doors and partitions in place. Doors and windows surrounding each area to be balanced shall be closed during testing and balancing operations. Air systems shall be complete and operable with registers, ducting, diffusers, returns, and control components in place. Fans shall be operational. Air motion and distribution from air terminals shall be as shown. All data including deficiencies encountered and corrective action taken shall be

recorded. If a system cannot be adjusted to meet the design requirements, promptly notify the Engineer in writing.

B. Air Systems

1. Each system shall be adjusted until all flow quantities are within plus 10% and minus 0%. Dampers shall be checked for tight shutoff. Air leakage around dampers shall be verified. Fans shall be checked for correct direction of rotation and proper speed shall be verified.

2. General Balancing Methods

a. Air flow adjustments shall be made by first adjusting the fan speed to meet the design flow conditions. Flows shall be checked at all supply and exhaust outlets. All flows shall be recorded before and after each adjustment.

C. Control Systems

1. Testing, adjusting, and balancing of the systems shall be coordinated with the control system installation. All control components shall be verified to be properly installed and operating as specified before proceeding with testing, adjusting, and balancing. Verification shall be in accordance with AABC MN-1.

2. Adjustment of the temperature controls shall be coordinated by the person in charge of the balancing and adjusting and shall be performed coincidental therewith. Simulate a complete cycle of operation for each system.

3.09 BASES AND SUPPORTS

A. In addition to supports and hangers as mentioned in Section 05500, provide all bases and supports not part of the building structure, of required size, type, and strength, as approved by the Engineer, for all equipment and materials furnished by him. All equipment, bases and supports shall be adequately anchored to the building structure to prevent shifting of position under operating conditions.

B. Furnish shop drawings and templates for all concrete foundations and supports for setting all required hanger and foundation bolts and other appurtenances necessary for the proper installation of his equipment.

3.10 MISCELLANEOUS IRON AND STEEL

A. All Work shall be cut, assembled, welded and finished by skilled mechanics. Welds shall be ground smooth. Stands, brackets, and framework shall be properly sized and firmly constructed.

B. Measurements shall be taken on the job and worked out to suit adjoining and connecting Work. All Work shall be by experienced metal working mechanics. Members shall be straight and true and accurately fitted. Scale, rust, and burrs shall be removed. Welded

joints shall be ground smooth where exposed. Drilling, cutting and fitting shall be done as required to properly install the Work.

C. Members shall be generally welded, except that bolting may be used for field assembly where welding would be impractical.

D. All shop fabricated iron and steel work shall be cleaned and dried and given a shop coat of paint on all surfaces and in all openings and crevices.

3.11 PLACING IN SERVICE

A. At the completion of performance tests and following approval of test result, recheck all equipment to see that each item is adequately lubricated and functioning correctly.

3.12 CLEANING AND ADJUSTING

A. During the progress of the Work, clean up and remove all oil, grease, and other debris caused by the Work performed under this section.

B. At the conclusion of the Project, clean and repair all areas and finishes as installed or affected by this installation of Work under this section.

C. Equipment: Equipment shall be wiped clean, with all traces of oil, dust, dirt, or paint spots removed. System shall be maintained in this clean condition until final acceptance. Bearings shall be properly lubricated with oil or grease as recommended by the manufacturer. Belts shall be tightened to proper tension.

3.13 INSULATION

A. Application - General

1. Installation: Except as otherwise specified, material shall be installed in accordance with the manufacturer's written instructions. Insulation materials shall not be applied until tests specified in other sections of the Specifications are completed. Material such as rust, scale, dirt and moisture shall be removed from surfaces to receive insulation. Insulation shall be kept clean and dry. Insulation shall not be removed from its shipping containers until the day it is ready to use and shall be returned to like containers or equally protected from dirt and moisture at the end of each workday. Insulation that becomes dirty shall be thoroughly cleaned prior to use. If insulation becomes wet or if aforementioned cleaning does not restore the surfaces to like new condition, the insulation may be rejected, and if rejected, shall be immediately removed from the jobsite. Joints shall be staggered on multilayer insulation. Mineral fiber thermal insulating cement shall be mixed with demineralized water when used on stainless steel surfaces. Insulation, jacketing and accessories shall be installed in accordance with MICA-01 standard plates except where modified herein or on the Contract Drawings.

2. Firestopping: Where pipes pass through fire walls and fire partitions, the penetration shall be sealed with firestopping materials as specified.

3. Flexible Cellular Insulation: Flexible cellular insulation shall be installed with seams and joints sealed with a contact adhesive. Flexible cellular insulation shall not be used on surfaces greater than 200 degrees F.

B. Pipe Insulation Installation

1. General: Pipe insulation shall be continuous and installed on fittings and appurtenances unless specified otherwise. Installation shall be with full length units of insulation and using a single cut piece to complete a run. Cut pieces or scraps abutting each other shall not be used.

2. Pipes Passing Through Sleeves

a. Pipe insulation shall be continuous through the sleeve.

b. An aluminum jacket with factory applied moisture barrier shall be provided over the insulation wherever penetrations require sealing.

c. Where penetrating interior walls, the aluminum jacket shall extend 2 inches beyond either side of the wall and shall be secured on each end with a band.

d. Where penetrating floors, the aluminum jacket shall extend from a point below the backup material to a point 10 inches above the floor with one band at the floor and one not more than 1 inch from the end of the aluminum jacket.

e. Where penetrating exterior walls, the aluminum jacket required for pipe exposed to weather shall continue through the sleeve to a point 2 inches beyond the interior surface of the wall.

3. Pipes Passing Through Hangers

a. Insulation, whether hot or cold application, shall be continuous through hangers. All horizontal pipes 2 inches and smaller shall be supported on hangers with the addition of a Type 40 protection shield to protect the insulation in accordance with MSS SP-69 whenever insulation shows signs of being compressed, or when the insulation or jacket shows visible signs of distortion at or near the support shield, insulation inserts as specified below for piping larger than 2 inches shall be installed.

b. Inserts shall be covered with a jacket material of the same appearance and quality as the adjoining pipe insulation jacket, shall overlap the adjoining pipe jacket 1-1/2 inches, and shall be sealed as required for the pipe jacket. The jacket material used to cover inserts in flexible cellular insulation shall conform to ASTM C 921, Type 1, and is allowed to be of a different material than the adjoining insulation material.

4. Flexible Cellular Pipe Insulation: Flexible cellular pipe insulation shall be tubular form. Sweat fittings shall be insulated with miter cut pieces the same size as on adjacent piping.

C. Duct Insulation Installation

1. Insulate supply ductwork from discharge of Packaged Rooftop Unit to supply outlet.

2. Insulate inside of Packaged Rooftop Unit roof curb with rigid insulation with a value of R-12.

3. Insulation shall be attached by applying Class 2 adhesive around the entire perimeter of the duct in 6 inch wide strips on 12 inch centers.

4. For ducts and plena, 24 inches and larger insulation shall be additionally secured to bottom of ducts by the use of mechanical fasteners. Fasteners shall be spaced on 18-inch centers and not more than 18 inches from duct corners.

5. Insulation shall be impaled on the mechanical fasteners where used and shall be pressed thoroughly into the adhesive. Care shall be taken to ensure vapor barrier jacket joints overlap 2 inches. The insulation shall not be compressed to a thickness less than that specified. Insulation shall be carried over standing seams and trapeze-type duct hanger. Self-locking washers shall be installed where mechanical fasteners are used. The pin shall be trimmed back and bent over.

6. Jacket overlaps shall be secured under the overlap with Class 2 adhesive and stapled on 4 inch centers. Staples and seams shall be coated with a brush coat of vapor barrier coating.

7. Breaks in the jacket material shall be covered with patches of the same material as the vapor barrier. The patches shall extend not less than 2 inches beyond the break or penetration in all directions and shall be secured with Class 2 adhesive and staples. Staples and joints shall be sealed with a brush coat of vapor barrier coating.

8. At jacket penetrations such as hangers and damper operating rods, voids in the insulation shall be filled and the penetration sealed with a brush coat of vapor barrier coating.

9. Insulation terminations and pin punctures shall be sealed and flashed with a reinforced vapor barrier coating finish. The coating shall overlap the adjoining insulation and uninsulated surface 2 inches. Pin puncture coatings shall extend 2 inches from the puncture in all directions.

10. Where insulation standoff brackets occur, insulation shall be extended under the bracket and the jacket terminated at the bracket.

D. Duct Test Holes: after duct systems have been tested, adjusted, and balanced, breaks in the insulation and jacket shall be repaired in accordance with the applicable section of this specification for the type of duct insulation to be repaired.

3.14 OPERATING AND MAINTENANCE INSTRUCTIONS

A. Operation and Maintenance Manuals shall be provided in accordance with Section 01730.

B. All operating equipment installed under this section shall be placed in operation and shall function continuously in an operating test for a period of one week without shutdown due to mechanical failure or necessity of adjustment. Prior to scheduling the Project Final Inspection and after completion of all installation and running adjustments, perform all Work required to place the equipment in complete operating condition to meet all requirements under the Specifications.

C. During this running test period, deliver to the designated representative of the Owner, through the Engineer, 6 complete sets of operating, service and replacement data for all equipment which will require operating maintenance or replacement and one copy of this literature shall be available during the instruction of the operating personnel while the other is checked for completeness by the Engineer.

3.15 TRAINING

A. Conduct a training course for the maintenance and operating staff. The training period of eight (8) hours normal working time shall start after the system is functionally complete but before the final acceptance tests. The training shall include all of the items contained in the operating and maintenance instructions as well as demonstrations of routine maintenance operations. The Engineer shall be given at least 2 weeks advance notice of such training.

B. During all working hours of the one-week operating test, instruction personnel shall be available for and provide thorough and detailed training to the Owner's operating and maintenance personnel in operation, maintenance and adjustment of all equipment installed.

C. Give sufficient notice to the designated operating personnel of the Owner in advance of this period. Upon completion of instruction, obtain from such representatives written verification on that which the above-mentioned instruction has been performed, such verification to be forwarded to the Engineer.

END OF SECTION

DIVISION 16

SECTION 16000

BASIC ELECTRICAL REQUIREMENTS

PART 1 – GENERAL

1.01 DESCRIPTION:

A. The Work of this section includes all labor, materials, tools, equipment, and accessory items and performing all operations necessary to furnish and install the complete electrical Work in accordance with this section of these specifications, the Drawings and the standards of the applicable codes listed herein.

B. The Work shall include, but not be limited to, furnishing and installation of equipment and items listed below and installation only of items furnished under other sections of these specifications.

1. Complete electrical building service as hereinafter specified.

2. Conduit, wire and electrical connections are required on certain items specified in sections of these specifications other than the electrical section. The Contractor shall examine all sections of these specifications to determine the complete scope of the Electrical Work.

3. Raceways and fittings

4. Wires and cables

5. Variable Frequency Drives

6. Miscellaneous equipment

7. Panelboards

8. Lighting systems

9. Generator

10. Grounding systems

11. Underground system

12. Fire/Security Alarm system

13. Communication system

C. Mount and wire operator's stations, and power conversion equipment for all variable speed drive systems furnished under other Divisions of these Specifications.

D. Install and make all field connections to variable frequency drives, process instrument panels and other control panels furnished under other Divisions of these Specifications.

E. Mount and wire process instruments and control cabinets furnished under other Divisions of these Specifications. Furnish and install all conduit, wire and interconnections between process instrumentation primary elements, transmitters, local indicators and receivers. Mount and wire all lightning and surge protection equipment at process instrumentation transmitters and receivers.

F. Mount and make field connections to “packaged” equipment furnished under other Divisions of these Specifications.

G. Provide conduit and power/control wiring for all HVAC (Heating, Ventilation and Air Conditioning), plumbing and fire protection equipment furnished under other Divisions of these Specifications.

H. Install and wire all thermostats, controllers and other devices furnished under other Divisions of these specifications which directly control HVAC equipment.

1.02 SUBMITTALS:

A. Submit the following in accordance with Section 01300:

1. Circuit breakers
2. Variable Frequency Drives
3. Dry type transformers
4. Panelboards
5. Generator
6. Automatic transfer switch
7. Lighting fixtures
8. Disconnect switches
9. Control stations
10. Miscellaneous equipment
11. Fire/Security Alarm System

B. The manufacturer's data sheets with product designation or catalog numbers shall be submitted for the following material:

1. Wire
2. Conduit
3. Receptacles
4. Boxes and fittings

C. Submit all other data as specified herein.

D. No material shall be ordered or shop Work started until the Engineer's approval of shop drawings has been given.

E. Prior to submitting shop drawings for lighting fixtures, verify the type of ceiling suspension systems being installed. Notify Engineer of any discrepancies between

fixture type specified and suspension system. Additional cost rising from failure to notify the Engineer will be the responsibility of the Contractor.

F. Operation and Maintenance Manuals - Prepare manuals in accordance with Section 01730.

G. Record Drawings - Prepare as specified in Part 1 of this Section.

1.03 DELIVERY, STORAGE AND HANDLING:

A. Provide in accordance with Section 01600 and as specified herein.

B. Electrical equipment shall at all times during construction be adequately protected against mechanical injury or damage by water. Electrical equipment shall not be stored out-of-doors. Electrical equipment shall be stored in dry permanent shelters. If stored for more than two weeks, the equipment shall receive all maintenance considerations required by the manufacturer for the proper storage of equipment. Proper storage in this context shall include the provision of heaters and dehumidifiers to keep the equipment dry at all times. If any apparatus has been damaged, such damage shall be repaired at no additional cost to the Owner. If any apparatus has been subject to possible injury by water, it shall be thoroughly dried out and put through such special tests as directed by the Engineer, or shall be replaced at no additional cost to the Owner.

1.04 DESIGN CRITERIA:

A. Service Characteristics

1. Primary Utility Voltage: 13.8KV

2. Secondary Building Voltage - High Level: 480/277 V

3. Secondary Building Voltage - Low Level: 120/208V

4. All equipment and wiring shall be suitable for the applied voltage.

B. Service and Metering

1. The power company serving this project is Eversource, Work Order #2361441.

2. The existing service shall be replaced with a new service that will be obtained at 480/277Volts, 3-phase, 4-wire from an existing utility pole and new pad mounted transformer provided by the utility company.

3. Furnish and install the primary service conduit and transformer mounting pad.
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3. Furnish and install the secondary service conduit, wire and connectors.

4. Eversource will provide the meter. The Contractor shall provide the meter socket and install all the metering equipment in accordance to the utility company requirements.

5. All Work and material for the electrical service shall be in accordance with the requirements of Eversource.

6. Make all arrangements with the Eversource for obtaining each service and furnish all labor and material for the services. Submit any utility fee invoice(s) associated with the service replacement to the Owner. The Owner shall make direct payment(s) for the fee(s) to Eversource.

C. Requirements of the Regulatory Agencies

1. The final, complete installation shall comply with all state and local statutory requirements having jurisdiction. The Contractor shall arrange for all necessary permits, pay all fees and arrange for all required inspections by local authorities. In general, all Work shall comply with the requirements of the National Electrical Code, all state codes and the codes and ordinances with the City of Framingham

D. Tests and Settings

1. Test all systems furnished and repair or replace all defective Work. Make all necessary adjustments to the systems and instruct the Owner's personnel in the proper operation of the system.

2. Make all circuit breaker and motor circuit protector settings based on the connected equipment manufacture’s recommendations.

3. The following minimum tests and checks shall be made prior to the energizing of electrical equipment. A certified test report shall be submitted stating that the equipment meets and operates in accordance with manufacturer’s and job specifications, and that equipment and installation conforms to all applicable standards and specifications.

   a. Testing of protective relays, static devices, transfer switches, circuit breakers and motor circuit protectors for calibration and proper operation and settings.

   b. Over potential, high potential, insulation resistance and shield continuity tests for cables.

   c. Mechanical inspection of switches, transfer switches and circuit breakers.

4. The Engineer shall be immediately notified of any unfavorable test results or indication of faulty equipment. No piece of equipment shall be energized until the test data is evaluated and the equipment is proven acceptable.

5. If the test and inspection data submitted should indicate deficiencies in the operation of the electrical apparatus or in the manufacturer thereof, the Contractor shall promptly implement the necessary adjustments, corrections,

modifications and/or replacements necessary to be made to meet the specified requirements.

1.05 RELATED WORK:

A. Excavation and backfilling, including gravel or sand bedding for underground Electrical Work is specified under DIVISION 2 - SITE WORK of these Specifications.

B. Concrete Work, including concrete electrical duct encasement, is specified under DIVISION 3 - CONCRETE of these Specifications.

1.06 SLEEVES AND FORMS FOR OPENINGS:

A. Provide and place all sleeves for conduits penetrating floors, walls, partitions etc. Locate all necessary slots for Electrical Work and form before concrete is poured.

1.07 CUTTING AND PATCHING:

A. All openings required by the Work of these Sections shall be planned for in advance. Any cutting and patching required by the lack of such planning shall be done by the Contractor at no additional cost to the Owner.

1.08 CORING:

A. Provide all coring for conduits penetrating floors, walls, partitions etc.

1.09 NEMA RATINGS FOR ELECTRICAL INSTALATION AND ENCLOSURES:

A. NEMA Type 12 for Building interior.

B. NEMA Type 4X for Building exterior.

1.10 INTERPRETATION OF DRAWINGS:

A. The Drawings are not intended to show exact routing of conduit runs or terminations. Contractor shall determine exact location of conduit terminations by examinations of approved shop drawings. The Contractor shall not reduce the size or number of conduit runs indicated on the Drawings.

B. The final routing of raceways shall be determined by structural conditions, interferences with other trades and by terminal locations on apparatus.

C. Locate pull boxes, panelboards, control pushbuttons, terminal cabinets, safety switches and such other apparatus as may require periodic maintenance, operation, or inspection, so that they are easily accessible. If such items are shown on the Drawings in locations which are found to be inaccessible, advise the Engineer of the situation before Work is advanced to the point where extra costs will be involved.

D. Each three-phase circuit shall be run in a separate conduit unless otherwise shown on the Drawings.

E. Unless otherwise approved by the Engineer conduits shown exposed shall be installed exposed; conduits shown concealed shall be installed concealed.

F. Where circuits are shown as “home-runs” all necessary fittings and boxes shall be provided for a complete raceway installation.

G. In general, wiring and raceway systems for lighting, receptacles, fire alarm, telephone and intercommunications systems are not indicated on the Drawings but shall be furnished and installed by the Contractor.

H. Each branch circuit shall have its own neutral, dedicated to that circuit. A common neutral for more than one single phase circuit is not allowed.

I. Verify with the Engineer the exact locations and mounting heights of lighting fixtures, switches and receptacles prior to installation.

J. Any Work installed contrary to Drawings shall be subject to change as directed by the Engineer at no additional cost to the Owner.

K. The locations of equipment, fixtures, outlets, and similar devices shown on the drawings are approximate only. Exact locations shall be as approved by the Engineer during construction. Obtain in the field all information relevant to the placing of electrical Work and in case of any interference with other Work, proceed as directed by the Engineer and furnish all labor and materials necessary to complete the Work in an approved manner.

L. Circuits on three phase panelboards shall be field connected to result in evenly balanced loads on each phase.

M. Surface mounted panel boxes, junction boxes, conduit, etc., shall be supported by spacers to provide a clearance between wall and equipment.

N. Circuit layouts are not intended to show the number of fittings, or other installation details. Furnish all labor and materials necessary to install and place in satisfactory operation all power, lighting, and other electrical system shown. Additional circuits shall be wherever needed to conform to the specific requirements of the equipment.

O. All connections to equipment shall be made as required, and in accordance with the approved shop and setting drawings.

P. Schematic diagrams shown on the drawings indicate the required functions only. Standard circuits of the particular manufacturer may be used to accomplish the functions indicated without exact adherence to the schematic drawings shown. Additional wiring or conduit required for such deviations shall be furnished at Contractor's expense. Contractor must ensure that all components necessary to accomplish the required function are provided.

1.11 SIZE OF EQUIPMENT:

A. Investigate each space in the structure through which equipment must pass to reach its final location. If necessary, the manufacturer shall be required to ship his material in sections sized to permit passing through such restricted areas in the structure.

B. The equipment shall be kept upright at all times. When equipment has to be tilted for ease of passage through restricted areas during transportation, the manufacturer shall be required to brace the equipment suitable, to insure that the tilting does not impair the functional integrity of the equipment.

1.12 TEMPORARY POWER AND LIGHTING

A. The Contractor shall furnish and install feeders of sufficient size from the utility company for the electric light and power requirements for the Project 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 in the building. Sufficient wiring, lamps, and outlets shall be installed to insure proper lighting in all rooms, space, and stairwells. Minimum sized lamp used shall be 1500 lumens. Where higher lighting intensities are required by Federal or State Standards of Laws or otherwise specified, the above specified lumens 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 Contractor.

C. The Contractor shall provide and maintain in each area of the building and the building exterior, 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. All temporary Electrical Work shall meet the requirements of the National Electrical Code Article 305 Temporary Wiring, the Local Utility Company, and all Federal Standards and Laws.

E. All temporary wiring and accessories thereto installed by the Contractor shall be removed after their purposes have been served.

F. The Contractor will pay for the cost of electric energy consumed.

G. 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 hours before and 2 hours after a normal eight (8) hour working day. In addition to the above, provide and maintain, to the satisfaction of the Owner, all temporary lighting and power that may be required for safety purposes.

1.13 RECORD DRAWINGS:

A. Record Drawings shall be provided under this Section in accordance with Section 01700 and as specified herein.

B. As Work progresses and for the duration of the Contract, maintain a complete and separate set of prints of Contract Drawings at the job site at all times. On a daily basis, record Work completed and all changes from original Contract Drawings clearly and accurately, including Work installed as a modification or addition to the original design such as change orders, instructions issued by the Engineer, or conditions encountered in the field.

C. Drawings shall show record condition of details, sections, and riser diagrams, and control changes. Schedules shall show actual manufacturer and make and model numbers of final equipment installation. Remove all superceded data to show the completed Work. Accurately indicate the location, size, type, and elevation of new utilities and their relationship to other utilities.

D. The Record Drawings will be used as a guide for determining the progress of the Work installed. They shall be inspected on a regular basis and shall be corrected immediately if found inaccurate or incomplete. Requisitions for payment will not be approved until the Drawings are accurate and up-to-date.

E. At completion of Work prepare a complete set of Record Drawings showing all systems as actually installed. The Contract Drawing electronic CAD files will be made available for this Contractor's copying, at his expense, into reproducibles to serve as backgrounds for the Record Drawings. Provide all drawings necessary to show the required as-built information. Submit three sets of prints to the Engineer for comments as to compliance with this Section. Make all modifications so noted by the Engineer.

F. Certify the accuracy of the record Drawings. Record Drawings shall become the property of the Owner.

1.14 COMPONENT INTERCONNECTIONS:

A. Components of equipment furnished under this Specification will not be furnished as integrated systems.

B. Analyze all systems components and their shop drawings; identify all terminals and prepare drawings or wiring tables necessary for component interconnection. Furnish two copies of interconnection wiring diagrams and tables to the Owner as part of the record drawings.

C. Furnish and install all component interconnections.

1.15 MANUFACTURER'S SERVICES:

A. Provide manufacturer's services for testing, training and start-up of the following equipment:

1. Generator.

2. Automatic Transfer Switch.

3. Variable Frequency Drives.

4. Fire/Security System.

5. The time required for each system shall be as hereinafter specified. The time specified shall be used as directed by the Engineer and shall not be used by the manufacturer or Contractor for field adjustments due to manufacturing or shipping defects.

1.16 MATERIALS:

A. Materials and equipment used shall be Underwriters Laboratories, Inc. listed wherever standards have been established by that agency. Written approval by the Engineer and local inspecting authority is required wherever UL Listed approval is not available.

B. Manufacturer of Principal Equipment

1. All lighting and power panelboards shall be made by one manufacturer.

2. All conduit of a given type shall be made by one manufacturer.

3. All wire and cables of a given type shall be made by one manufacturer.

4. All variable frequency drives furnished shall be made by one manufacturer.

1.17 WARRANTY:

A. Provide warranty and guarantee on all equipment furnished and Work performed for a period of one (1) year from the date of substantial completion.

PART 2 (NOT USED)

PART 3 (NOT USED)

- END OF SECTION -

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SECTION 16060

GROUNDING SYSTEMS

PART 1 – GENERAL

1.01 DESCRIPTION:

A. The work of this section includes the furnishing and installing of a complete grounding system in strict accordance with Article 250 of the National Electrical Code and as specified herein and as shown on the drawings.

1.02 SUBMITTALS:

A. Submit the following in accordance with Section 01300:

1. Conduit
2. Wire
3. Ground rods
4. Ground bus bars

1.03 DELIVERY, STORAGE AND HANDLING:

A. Provide in accordance with Section 01600.

B. All materials shall be shipped, stored, handled and installed in such a manner as not to degrade quality, serviceability, or appearance.

PART 2 – PRODUCTS

2.01 CONDUIT:

A. Conduit shall be as specified under Section 16130 (Raceways and Fittings).

2.02 WIRE:

A. Wire shall be as specified under Section 16120 (Wire and Cables).

2.03 GROUND RODS:

A. Ground rods shall be copper clad steel 3/4 inch in diameter and 10 feet in length unless otherwise shown on the drawings. Rods shall one 10 foot length rod. Ground rods shall be Copperweld, equal by A.B. Chance Co., or equal.

2.04 GROUNDING BUS BARS:

A. Grounding bus bars shall be copper, not less than ¼ inch by 2 inch by 24 inch.

B. All lugs, bolts and nuts shall be silicon bronze.

C. Bus bars to be securely mounted to room wall with brackets and insulators.

PART 3 – EXECUTION

3.01 INSTALLATION:

A. Grounding electrode conductors shall be run in rigid steel conduits. Protecting conduits shall be bonded to the grounding electrode conductors at both ends.

B. Grounding conductors shall be run with feeders where shown on the drawings or hereinafter specified.

C. Liquid tight flexible metal conduit in sizes 1 inch and larger shall have bonding jumpers. Bonding jumpers shall be external, run parallel (not spiraled) and fastened with plastic tie wraps. Tie wraps shall be installed 12 inches apart and not more than 6 inches from ends.

D. Connect the following equipment by separate wire or cable directly to the grounding grid system:

1. Frame of each transformer
2. Neutral of each transformer
3. Service entrance circuit breaker
4. Ground buses
5. Metal Fencing
6. Generator Enclosure
7. Door frames and railings.

E. Connect the following equipment by separate wire or cable to the ground bus in the distribution equipment servicing the equipment:

1. Switchboard
2. Panelboards
3. 480 Volt motors
4. Control panels
5. All feeders and branch circuits
6. Receptacle circuits

F. The following equipment shall be grounded through the metallic raceway systems with permanent and effective ground connections:

1. All metal cases and support frames
2. Lighting system
3. 120 Volt motors

G. Bond the following N.E.C. approved electrodes together to form a ground grid system:

1. Metallic water main
2. Building steel frame
3. Steel reinforcing rods within concrete at 4 ft. intervals.
4. Grounding rods and buses

5. Buried bare copper conductors

H. Grounding electrodes shall be driven where shown on the drawings. Spacing between electrodes shall be twice the length of the electrodes.

I. All grounding connections shall be made by means of approved bronze clamps. Exposed connections between different metals shall be sealed with No-Oxide Paint Grade A, or equal.

J. All buried connections shall be made by a thermic welding process equal to Cadweld. Molds used for the welding process shall be new having no prior usage. Molds shall be the specific type for the connection to be made.

K. Light fixture bases shall be furnished with a grounding point.

L. All buried conductors shall be laid slack in trenches. The earth surrounding the cables shall be void of sharp objects which may injure the cables. Backfill material shall be natural earth. Where cables are exposed to mechanical injury they shall be protected by pipes or other substantial guards. If guards are iron pipe or other magnetic material, conductors shall be electrically connected to both ends of the guard. Connections shall be made as hereinbefore specified.

M. Do not allow water main connection to be painted. If the connections are painted, they shall be disassembled and remade with new fittings.

3.02 TESTING:

A. The grounding system shall be tested under this section.

B. The equipment grounding shall be checked to insure continuity of the ground return path.

C. The ground grid systems shall be tested using the three terminal fall in potential method. A minimum of eight test points for each ground grid system shall be submitted for review by the Engineer. The test points shall be made along a straight line from the grid system to the reference terminal. The distance between the grid system and the reference terminal shall be consistent with normal practices for ground testing.

D. All test equipment shall be furnished hereunder and shall be similar to Biddle Earth Tester No. 250220 or equal.

E. These tests shall be performed during the dry season. Tests shall be performed before loaming and seeding or paving work has been performed.

F. The Contractor shall notify the Engineer immediately if the ground grid system exceeds 5 ohms.

3.03 CLOSEOUT ACTIVITIES:

A. Provide in accordance with Section 01700.

- END OF SECTION -

SECTION 16080

UNDERGROUND SYSTEMS

1.00 PART 1 – GENERAL

1.01 SCOPE:

A. The work of this section includes furnishing and installing of a complete underground system of raceways, handholes, and frames and covers as specified herein and as shown on the drawings.

1.02 SUBMITTALS:

A. Submit the following in accordance with Section 01300:

1. Raceways
3. Warning Tape

1.03 DELIVERY, STORAGE AND HANDLING:

A. Provide in accordance with Section 01600.

B. All materials shall be shipped, stored, handled and installed in such a manner as not to degrade quality, serviceability, or appearance.

2.00 PART 2 – PRODUCTS

2.01 RACEWAYS:

A. Raceways shall be PVC schedule 40 conduit. Raceway materials shall be in accordance with Section 16130 (Raceways and Fittings).

2.02 DETECTABLE METTALIC WARNING TAPE

A. Warning tape shall be red laminated covered aluminum core, 5mil thickness, 2 inch minimum width.

3.00 PART 3 – EXECUTION

3.01 INSTALLATION:

A. Raceways shall be installed to drain away from buildings. Raceways between handholes shall drain toward the handholes. Raceway slopes shall not be less than 3 inches per one hundred feet.

B. Raceway banks shall be encased in concrete. Concrete shall be reinforced with steel rods.

C. Plastic spacers shall be used to hold raceways in place. Spacers shall provide not less than two inch clearance between raceways.

D. The minimum cover for raceway banks shall be 30 inches unless otherwise permitted by the Engineer.

E. Raceway entrances to buildings and structures shall be made with steel conduit not less than ten feet long.

F. Conduits in duct banks entering buildings and structures shall be spread to allow adequate room for conduit wall seals, pull and terminal boxes.

G. Where bends in raceways are required, long radius elbows, sweeps and offsets shall be used. Sweeps at riser pole shall be rigid steel encased in concrete.

H. All raceways shall be swabbed clean before cable installation.

I. Spare raceways shall be plugged and sealed watertight at all buildings and structures.

J. Raceways in use shall be sealed watertight at all buildings and structures.

K. Rigid steel conduit shall be used for risers at the service pole and other locations shown on the drawings. Conduit sweep at pole base shall be rigid steel conduit.

L. Raceway terminations at manholes shall be with end bells.

M. Pulling-in irons shall be installed opposite all raceway entrances to manholes.

N. All underground metallic conduit run underground in direct contact with earth shall be coated with asphaltum or bitumastic varnish or similar corrosion protection the entire length of the run.

O. All underground raceways/ductbanks shall be marked with warning tape located approximately 12 inches below grade above the raceway/ductbank.

P. Refer to paragraph titled "Conduit Embedded in Slabs" in Section 16050 (Electrical General Conditions).

END OF SECTION

SECTION 16085

MISCELLANEOUS EQUIPMENT

PART 1 – GENERAL

1.01 DESCRIPTION

A. The work of this section includes the furnishing and installing of all miscellaneous equipment as specified herein and as shown on the drawings.

1.02 SUBMITTALS

A. Submit the following in accordance with Section 01300:

1. Automatic transfer switch
2. Manual transfer switch
3. Generator docking station
4. Surge Suppression Devices
5. Disconnect switches
6. Motor starters
7. Transformers
8. Circuit breakers
9. Enclosure types
10. Wireway
11. Nameplates
12. Meter Socket
13. Floor Mats

B. Operation and Maintenance Manuals - Prepare manuals in accordance with Section 01730.

C. Record Drawings - Prepare as specified in Section 16000.

1.03 DELIVERY, STORAGE AND HANDLING

A. Provide in accordance with Section 01600.

B. All materials shall be shipped, stored, handled and installed in such a manner as not to degrade quality, serviceability, or appearance.

1.04 DESIGN CRITERIA

A. All circuit breakers, magnetic motor starters, and fuses furnished under this section shall be of the same manufacturer for each type of equipment.

PART 2 – PRODUCTS

2.01 AUTOMATIC TRANSFER SWITCH

A. The automatic transfer switch shall be true 3-pole, solid neutral type, microprocessor based control designed for an emergency and normal source of 480 Volts, 3 Phase, 4 Wire, 60 Hertz. Current ratings shall be as indicated on the drawings.

B. The complete switch assembly including accessories shall be listed under UL-1008 for use on emergency systems.

C. The complete transfer switch assembly shall be factory tested to ensure proper operation and compliance with the specification requirements. A copy of the factory test report shall be available upon request.

D. System Operation

1. When the voltage on any phase of the normal source drops below 80% or increases to 120%, or frequency drops below 90%, or increase to 110%, or 20% voltage differential between phases occurs, after a programmable time delay period of 0-9999 seconds factory set at 3 seconds to allow for momentary dips, the engine starting contacts shall close to start the generating plant.

2. The transfer switch shall transfer to emergency when the emergency source has reached specified voltage and frequency on all phases.

3. After restoration of normal power on all phases to a preset value of at least 90% to 110% of rated voltage, and at least 95% to 105% of rated frequency, and voltage differential is below 20%, an adjustable time delay period of 0-9999 seconds (factory set at 300 seconds) shall delay retransfer to allow stabilization of normal power. If the emergency power source should fail during this time delay period, the switch shall automatically return to the normal source.

4. After retransfer to normal, the engine generator shall be allowed to operate at no load for a programmable period of 0-9999 seconds, factory set at 300 seconds.

E. Construction

1. The transfer switch shall be double throw, actuated by two electric operators momentarily energized, and connected to the transfer mechanism by a simple over center type linkage. Dual circuit breaker or movable beam construction is not acceptable. Minimum transfer time shall be 400 milliseconds.

2. The normal and emergency contacts shall be positively interlocked mechanically and electrically to prevent simultaneous closing. Main contacts shall be mechanically locked in both the normal and emergency positions without the use of hooks, latches, magnets, or springs, and shall be silver-tungsten alloy. Separate arcing contacts with magnetic blowouts shall be provided on all transfer switches. Interlocked, molded case circuit breakers or contactors are not acceptable.

3. The transfer switch shall be equipped with a safe manual operator, designed to prevent injury to operating personnel. The manual operator shall provide the same contact to contact transfer speed as the electrical operator to prevent a flashover from switching the main contacts slowly.

4. Transfer switch shall be adequately constructed to carry its full rated current on a continuous 24 hour basis in all approved enclosures and shall not show excessive heating or be subject to de-rating.

5. The minimum withstand and close-in current rating in symmetrical amperes shall be equal to or greater than the interrupting rating of the normal power source circuit breaker. In no case shall this rating be less than 20 times the transfer switch full load current rating. The switch contacts shall not weld or be damaged in any way as a result of a fault of up to the withstand and close-in rating.

6. The main contacts shall be visible for inspection without any major disassembly of the transfer switch.

7. A fully rated solid neutral bus bar with required AL-CU neutral lugs shall be provided.

8. Control components and wiring shall be front accessible. All control wires shall be multiconductor 18 gauge 600-volt SIS switchboard type point to point harness. All control wire terminations shall be identified with tubular sleeve-type markers.

9. The switch shall be equipped with 90 degrees C rated copper/aluminum solderless mechanical type lugs.

10. The switch enclosure shall be NEMA 12.

F. Controls

1. The transfer switch shall be equipped with a microprocessor based control system, to provide all the operational functions of the automatic transfer switch. The controller shall have two asynchronous serial ports. The controller shall have a real time clock with NiCad battery back up.

2. The CPU shall be equipped with self diagnostics which perform periodic checks of the memory I/O and communication circuits, with a watchdog/power fail circuit

3. A door mounted controller with a 20 character, LCD display, with a keypad, which allows access to the system shall be provided The controller shall have password protection required to limit access to qualified and authorized personnel.

4. The controller shall include three-phase over/under voltage, over/under frequency, phase sequence detection and phase differential monitoring on both normal and emergency sources.

5. The controller shall be capable of storing the following records in memory for access either locally or remotely:

   a. Number of hours transfer switch is in the emergency position (total since record reset).

   b. Number of hours emergency power is available (total since record reset).

   c. Total transfer in either direction (total since record reset).

   d. Date, time, and description of the last four source failures.

   e. Date of the last exercise period.

   f. Date of record reset.

G. Accessories

1. Programmable three phase sensing of the normal source set to pickup at 90% and dropout at 80% of rated voltage and overvoltage to pickup at 120% and dropout out at 110% of rated voltage. Programmable frequency pickup at 95% and dropout at 90% and over frequency to pickup at 110% and dropout at 105% of rated frequency. Programmable voltage differential between phases, set at 20%, and phase sequence monitoring.

2. Programmable three phase sensing of the emergency source set to pickup at 90% and dropout at 80% of rated voltage and overvoltage to pickup at 120% and dropout out at 110% of rated voltage programmable frequency pickup at 95% and dropout at 90% and over frequency to pickup at 110% and dropout at 105% of rated frequency. Programmable voltage differential between phases set at 20%, and phase sequence monitoring.

3. Time delay for override of momentary normal source power outages (delays engine start signal and transfer switch operation). Programmable 0-9999 seconds. Factory set at 3 seconds, if not otherwise specified.

4. Time delay to control contact transition time on transfer to either source. Programmable 0-9999 seconds, factory set at 3 seconds.

5. Time delay on retransfer to normal, programmable 0-9999 seconds, factory set at 300 seconds if not otherwise specified, with overrun to provide programmable 0-9999 second time delay, factory set at 300 seconds, unloaded engine operation after retransfer to normal.

6. Time delay on transfer to emergency, programmable 0-9999 seconds, factory set at 3 seconds.

7. A maintained type load test switch shall be included to simulate a normal power failure, keypad initiated.

8. A time delay bypass on retransfer to normal shall be included. Keypad initiated.

9. Dry contact, rated 10 Amps 120 volts AC, to close on failure of normal source to initiate engine starting.

10. Dry contact, rated 10 Amps 120 volts AC, to open on failure of normal source for customer functions.

11. Light emitting diodes shall be mounted on the microprocessor panel to indicate: switch is in normal position, switch is in emergency position and controller is running.

12. A exerciser shall be provided with (10) 7-day events, programmable for any day of the week and (24) calendar events, programmable for any month/day, to automatically exercise generating plant programmable in one-minute increments. Also include selection of either "no load" (switch will not transfer) or "load" (switch will transfer) exercise period. Keypad initiated.

13. Provision to select either "no commit" or "commit" to transfer operation in the event of a normal power failure shall be included. In the "no commit position," the load will transfer to the emergency position unless normal power returns before the emergency source has reach 90% of it's rated values (switch will remain in normal). In the "commit position" the load will transfer to the emergency position after any normal power failure. Keypad initiated.

14. Two auxiliary contacts rated 10 Amp, 120 volts AC , shall be mounted on the main shaft, one closed on normal, the other closed on emergency. Both contacts will be wired to a terminal strip.

15. A three phase digital LCD voltage readout, with 1% accuracy shall display all three separate phase to phase voltages simultaneously, for both the normal and emergency source.

16. A digital LCD frequency readout with 1% accuracy shall display frequency for both normal and emergency source.

17. An LCD readout shall display normal source and emergency source availability.

18. Include (2) time delay contacts that open simultaneously just (milliseconds) prior to transfer in either direction. These contacts close after a time delay upon transfer. Programmable 0-9999 seconds after transfer.

2.02 MANUAL TRANSFER SWITCHES

A. The manual transfer switch shall be UL 1008 listed, designed for an emergency and normal source of 480 Volts, 3 Phase, 4 Wire, 60 Hertz. Current ratings shall be as indicated on the drawings.

B. Each switch shall be mounted in a NEMA 12 wall mounted enclosure

C. The transfer switch shall be of double throw contact construction with an 3-postion emergency-off-normal external handle.

2.03 GENERATOR DOCKING STATION

A. Docking station shall include 16 Series Camlok Panel Mounts for use as connection to portable generator.

B. Entire package must be listed to ETL or UL 1008 Standards. UL listing of individual components is not acceptable.

C Enclosures:

1. NEMA 3R rain-tight, aluminum enclosure

2. Pad-lockable front door shall include a hinged access plate at the bottom for entry of cables from portable generator or portable load bank. NEMA 3R integrity shall be maintained with access plate open for cable entry.

3. Front and side through a front access panel shall be accessible for maintenance.

4. Top, side, and bottom through a front access panel shall be accessible for permanent cabling.

D. Phase, Neutral, and Ground Buses:

1. Material: Silver-plated Copper

2. Equipment Ground Bus: bonded to box.

3. Isolated Ground Bus: insulated from box.

4. Ground Bus: 50% of phase size.

5. Neutral Bus: Neutral bus rated 100 percent of phase bus.

E. Generator connectors shall be male Camlok style mounted on gland plate, color coded according to system voltage

1. A phase – Black or Brown

2. B phase – Red or Orange

3. C phase – Blue or Yellow

4. N Neutral – White

5. G Ground – Green

F. Temporary connectors shall include protective flip lids to prevent accidental contact.

G. Permanent connectors shall be broad range set-screw type, located behind an aluminum barrier.

H. Short Circuit & Withstand Rating: 65KAIC.

I. Panel mounted Phase monitoring relay.

2.04 SURGE PROTECTION DEVICE (SPD)

A. Electrical Service SPD

1. Certify unit listed to UL 1449, 3rd Edition and UL 1283.

2. SPD shall be UL labeled as Type 1, intended for use without need for external or supplemental overcurrent devices. Every suppression component of every mode, including N-G, shall be protected by internal overcurrent and thermal over-temperature controls. SPDs relying upon external or supplementary installed safety disconnectors do not meet the intent of this specification.

3. SPD to be enclosed, surfaced mount and to include surge counter, audible alarm and dry contact for remote status.

4. Minimum surge current capability (single pulse rated) per phase shall be 200kA

5. Voltage Protection Ratings (VPRs) shall not exceed the following:

System Voltage	L-N	L-G	L-L	N-G
208Y/120	700V	700V	1000V	600V

480Y/277	1200V	1200V	2000V	1200V

6. Maximum Continuous Operating Voltage (MCOV) (verifiable at UL.com):

System Voltage	Allowable System Voltage Fluctuation (%)	MCOV
208Y/120	25%	150V
480Y/277	15%	320V

7. SPD shall be installed per manufacturer's installation instructions with lead lengths as short (less than 24") and straight as possible. Gently twist conductors together.

B. Telephone Service TVSS

1. Telephone system protection, high speed, fused, solid state design shall be provided on the incoming telephone service line.

2. UL 497A listed, low capacitance type, with female jacks, input and output.

2.05 DISCONNECT SWITCHES (VISIBLE BLADE TYPE)

A. Visible blade type disconnect switches shall be heavy-duty, quick-make, quick-break, visible blades, 600 Volt, 3 pole with full cover interlock.

B. Enclosure shall meet the area NEMA designation for which they are located.

C. NEMA Type 12, and 4X enclosures shall be as specified herein.

D. Disconnect switches shall be as manufactured by Square D, ABB, or General Electric Co.

2.06 DISCONNECT SWITCHES (TOGGLE TYPE)

A. Toggle type disconnect switches shall be quick-make, quick-break with handle guard and lock-off feature.

B. Switches shall be provided for resistance, non-motor type loads only. Switches shall not be installed where full load current of utilization equipment exceeds 18 Amperes.

C. Switches shall be rated 20 Amperes at 600 Volts and 30 Amperes at 250 Volts, 60 Hertz, 2 or 3 pole.

D. Enclosure shall meet the area NEMA designation for which they are located.

E. NEMA Type 12 and 4X enclosures shall be as specified herein.

F. Disconnect switches shall be provided by Square D, ABB, or General Electric Company.

2.07 MANUAL MOTOR STARTERS

A. Manual starters shall be non-reversing, reversing or two speed type as shown on the drawings. Built-in control stations shall be provided where shown on the drawings.

B. Enclosure shall meet the area NEMA designation for which they are located.

C. NEMA Type 12 and 4X enclosures shall be as specified herein.

D. Provide handle guard kit with padlock provisions.

E. Manual motor starters shall be as manufactured by the Square D, ABB, or General Electric Co.

2.08 DRY TYPE TRANSFORMERS

A. Dry type transformers shall be dry type, copper, two-winding with KVA and voltage ratings as shown on the drawings.

B. Transformers shall be furnished with full capacity primary voltage taps as follows:

1. 0.25 KVA to 2 KVA - None

2. 3 KVA to 10 KVA - Two - 5 percent below normal.

3. 11 KVA to 500 KVA - Two - 2-1/2 percent below normal and two 2-1/2 percent above normal.

C. Transformers shall be designed for indoor or outdoor service as required for the locations shown on the drawings.

D. Transformers shall be designed in accordance with ANSI, IEEE and NEMA standards.

E. Normal efficiency transformers shall be furnished in sized to 15 KVA. Maximum temperature rise of transformers as measured by resistance above a 40 degree C ambient shall not exceed:

1. 115 degree C for transformers rated up to 25 KVA.
2. 80 degree C for transformers rated up to 500 KVA.

F. Energy efficient transformers shall be furnished in ratings 30 KVA and larger and certified to meet DOE 10 CFR Part 431:2016. Temperature rise of transformers above a 40 degree C ambient shall not exceed 80 degree C.

G. All insulating materials shall be in accordance with NEMA standards for a 220 degree C UL component recognized insulation system.

H. Transformers shall be manufactured by Square D Co., General Electric Co., Hammond Corp., or equal.

2.09 ENCLOSED CIRCUIT BREAKERS

A. Circuit breakers shall be molded case, three pole unless otherwise noted, with voltage rating as required. Ampere rating shall be as shown on the drawings. Provide with service entrance rating where required.

B. Main breaker shall be solid state with digital trip and adjustable trip setting with LED on face of breaker providing amps per phase. Provide auxiliary contacts for trip status to remote alarm.

C. The interrupting capacity shall be not less than 65,000 Amperes, RMS symmetrical at 480V AC.

D. All circuit breakers with 225 Ampere frames and larger shall have interchangeable trips.

E. Enclosure shall meet the area NEMA designation for which they are located.

F. NEMA Type 12 and 4X enclosures shall be as specified herein.

2.10 ENCLOSURE TYPE

A. NEMA Type 12 enclosure shall be general purpose sheet steel.

B. NEMA Type 4X enclosures shall be cast iron or stainless steel.

211 WIREWAY

A. Wireway shall be steel.

B. Wireway shall be manufactured by General Electric Co., or equal by Siemens Corp or Hoffman Enclosures.

2.12 NAMEPLATES

A. Nameplates shall be provided for all special purpose tumbler switches, disconnect switches, remote control stations, motor starters, time clocks, panelboards, terminal cabinet, etc. to designate the equipment controlled and function.

B. Nameplates shall be black and white laminated, phenolic material having engraved letters approximately 1/4 inch high, extending through the black face into the white layer.

C. Nameplates shall be attached to the panel by self-tapping stainless steel screws or rivets.

2.13 METER SOCKET

A. Meter socket shall be NEMA 3R and of the type approved by the power company.

2.14 FLOOR MATS

A. Provide 1/4" x 36" corrugated all rubber insulating matting in front of new 480V power distribution equipment.

B. Matting shall be proof tested to 20,000 volts and conform to ASTM D178-93.

C. Matting to be manufactured by Biltrite or equal.

PART 3 – EXECUTION

3.01 INSTALLATION

A. All field mounted devices shall be mounted four feet-six inches above the finished floor or grade. Devices shall be adequately supported on walls, columns or other supports. The Contractor shall furnish and install channel iron imbedded in the ground or floor to support devices where necessary.

B. All control equipment shall be identified as to the equipment it controls. Provide lamacoid nameplates at all equipment.

3.02 TESTS AND CHECKS

A. The following minimum tests and checks shall be made before energizing the automatic transfer switch.

1. Perform insulation resistance tests phase-to-phase and phase-to-ground with switch in both source positions. The Insulation resistance test voltages and minimum values to be in accordance with manufacturer's published data.

2. Measure contact resistance in normal and alternate source position.

3. Determine contact resistance in micro-ohms. Investigate any value exceeding 500 micro-ohms or any values which deviate from adjacent poles by more than fifty percent (50%).

- END OF SECTION -

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SECTION 16120

WIRES AND CABLES

PART 1 – GENERAL

1.01 DESCRIPTION

A. The work of this section includes the furnishing, installing and testing of all wire, cable and appurtenances as specified herein and as shown on the drawings. All wiring of a given type shall be the product of one manufacturer.

1.02 SUBMITTALS

A. Submit the following in accordance with Section 01300:

1. Wire
2. Cable
3. Terminations
4. Lugs
5. Wire and Cable Markers

1.03 DELIVERY, STORAGE AND HANDLING

A. Provide in accordance with Section 01600.

B. All materials shall be shipped, stored, handled and installed in such a manner as not to degrade quality, serviceability, or appearance.

1.04 DESIGN CRITERIA

A. Wire for single phase circuits shall be Type XHHW or THWN-THHN.

B. Wire for three phase circuits shall be Type XHHW.

C. Single conductor wire for control, indication and metering shall be Type THWN/THHN No. 12 or 14 AWG, stranded.

D. Multi-conductor control cable shall be used for the underground system and shall be No. 12 or 14 AWG, stranded with an overall jacket.

E. Wire for process instrumentation shall be twisted shielded pairs No. 16 AWG, stranded.

F. Ground wires shall be Type THW, green. Bare ground wires shall be soft drawn copper, 98 percent conductivity.

1.05 MINIMUM SIZES

A. Except for control and signal wiring, no wire smaller than number 12 AWG shall be used.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Wires and cables shall be of annealed, 98 percent conductivity, soft drawn copper.

B. All conductors shall be stranded.

2.02 600 VOLT WIRE

A. Type XHHW shall be cross-linked polyethylene, as manufactured by Prysmian Cable Corp., Collyer Insulated Wire Co., The Okonite Co. or equal.

B. Type THWN/THHN shall be as manufactured by Prysmian Cable Corp., Collyer Insulated Wire Co., The Okonite Co. or equal.

C. Multi-conductor control cable shall be stranded, 600 Volt, cross-linked polyethylene insulated, neoprene jacketed, as manufactured by Allied Wire and Cable, or equal.

2.03 INSTRUMENTATION CABLE

A. Process instrumentation wire shall be twisted pair, 600 Volts, polyethylene insulated, aluminum tape, tinned copper braid shielded, polyvinyl chloride jacketed, as manufactured by Okonite Co., Belden Corp., or equal.

2.04 CAT6 CABLE

A. CAT6 cable shall be UL listed, NEC CL2, CAT 6 type with 4 pair copper, UTP, 23 Awg conductors.

B. CAT6 cables to be labeled and tested for continuity by contractor per manufacturer’s specifications.

C. Provide wall plates and jack connectors.

2.05 CONNECTORS AND TERMINAL LUGS

A. Splices for No. 10 or No. 12 A.W.G. solid wires, such as for lighting branch circuits, shall be made with insulated wire connectors.

B. Connectors and terminal lugs on wires No. 8 A.W.G. and larger shall be of the mechanical or clamp type.

2.06 WIRE AND CABLE MARKERS

A. Wire and cable markers shall be “Omni-Grip” as manufactured by W.H. Brady Co., or equal.

B. Wire and cables with diameters exceeding the capacity of the “Omni-Grip” shall be marked with pre-printed, self-adhesive vinyl tapes as manufactured by W.H. Brady Co., T&B Fasteners Inc., or equal.

C. The "to" and "from" destinations shall be clearly identified on each cable at each termination and within manholes, pull boxes and junction boxes.

PART 3 – EXECUTION

3.01 INSTALLATION

A. All conductors shall be carefully handled to avoid kinks or damage to insulation.

B. All wires, cables and each conductor of multi-conductor cables (except lighting and receptacle wiring) shall be uniquely identified at each end with wire and cable markers.

1. Where wiring originates from a motor control center or process control panel the wire identification number shall incorporate the terminal numbers used in the control center or panel and a number to identify the motor control center or panel.

2. Wires shall be identified at both ends and at intermediate junction boxes, terminal cabinets, etc. Wire identification numbers shall be unique.

3. A typed list of the numbers used at each motor control center and control cabinet shall be submitted with the as built drawings.

C. Lubrications shall be used to facilitate wire pulling. Lubricants shall be U.L. approved for use with the insulation specified.

D. Shielded instrumentation wire shall be installed from terminal to terminal with no splicing at any intermediate point.

E. Shielded instrumentation wire shall be installed in rigid steel conduit and pull boxes that contain only shielded instrumentation wire.

F. Shielding on instrumentation wire shall be grounded at the transmitter end only.

G. Each branch circuit shall have a dedicated neutral.

H. Cables penetrating fire rated floors, walls, etc. shall be fireproofed. Fireproofing material shall be U.L. classified for three hour fire rating. Fire-proofing system shall be as manufactured by 3M Co., Thomas & Betts, or equal.

I. Power conductors (other than lighting & receptacle) shall be run continuous and splicing should be kept to a minimum. The Engineer should be informed of where splices will occur.

3.02 TESTS

A. All 600 Volt wire insulation shall be tested with a megohm meter after installation. Tests shall be made at not less than 500 Volts. Submit a written test report of the results to the Engineer.

- END OF SECTION -

SECTION 16130

RACEWAYS AND FITTINGS

PART 1 – GENERAL

1.01 DESCRIPTION

A. The work of this section includes the furnishing and installing of complete raceway systems as specified herein and as shown on the drawings.

B. All raceway systems shall be complete with fittings, boxes or cabinets, and necessary connections to result in a complete system.

1.02 SUBMITTALS

A. Submit the following in accordance with Section 01300:

1. Raceways.

2. Boxes and Fittings.

1.03 DELIVERY, STORAGE AND HANDLING

A. Provide in accordance with Section 01600.

B. All materials shall be shipped, stored, handled and installed in such a manner as not to degrade quality, serviceability, or appearance.

1.04 DESIGN CRITERIA

A. Except where otherwise shown on the drawings, or hereinafter specified, all raceways installed aboveground shall be rigid heavy wall galvanized steel conduit.

B. PVC Schedule 40 conduit shall be used underground except as specified herein and where otherwise indicated on the drawings.

C. When routing signal cables in raceways, maintain 12” spacing from power raceways and only cross at a 90 degree angle. All VFD power feeds to motors shall be routed in rigid steel material, NO EXCEPTION.

D. Unless otherwise hereinafter specified or shown on the drawings, all boxes shall be metal.

E. Exposed switch, outlet and control station boxes and fittings shall be cast or malleable iron.

F. Concealed switch, outlet and control station boxes in masonry walls shall be pressed steel.

G. Combination expansion-deflection fittings shall be used where conduits cross structure expansion joints. Refer to Structural drawings for expansion joint locations.

H. Fire stops shall be used where cables or conduits penetrate through fire resistant rated walls, floors, ceilings or partitions.

I. Galvanized rigid steel conduit sweeps shall be used where underground PVC conduits rise up from grade.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Rigid Conduit

1. Rigid heavy wall steel conduit shall be hot-dipped galvanized as manufactured by the Youngstown Sheet and Tube Co., Allied Tube and Conduit Corp., Wheeling-Pittsburgh Steel Corp., or equal.

2. PVC conduit, where installed concealed in floor slabs, walls or underground shall be rigid polyvinyl chloride Schedule 40 as manufactured by Carlon, Phillips Petroleum Co., Triangle Pipe & Tube Co., Inc., or equal.

B. Liquidtight, Flexible Metal Conduit, Couplings and Fittings.

1. Liquidtight, flexible metal conduit shall be Sealtite, Type UA, as manufactured by Anaconda American Brass Co., or equal by American Flexible Conduit Co., Inc., or equal.

2. Fittings used with flexible conduit shall be of the screw-in type as manufactured by Thomas and Betts Co., Crouse-Hinds Co., O.Z. Manufacturing Co., or equal.

C. Flexible couplings shall be as manufactured by Crouse-Hinds Co., Appleton Electric Co., O.Z. Manufacturing Co., or equal.

D. Boxes and Fittings

1. Pressed steel switch and outlet boxes shall be hot-dipped galvanized as manufactured by Raco Manufacturing Co., Adalet Co., O.Z. Manufacturing Co., or equal.

2. All boxes including, but not limited to, terminal boxes, junction boxes and pull boxes shall be sheet steel unless otherwise shown on the drawings. Boxes shall be galvanized and have continuously welded seams. Welds shall be ground

smooth and galvanized. Box bodies shall be flanged and shall not have holes or knockouts. Box bodies shall not be less than 14 gauge metal and covers shall not be less than 12 gauge metal. Covers shall be gasketed and fastened with stainless steel screws. Boxes shall be as manufactured by Hoffman Engineering Co. or equal.

3. Cast or malleable iron boxes and fittings shall be galvanized with cast galvanized covers and corrosion-proof screws as manufactured by the Crouse-Hinds Co., Appleton Electric Co., O.Z. Manufacturing Co., or equal.

4. PVC boxes and fittings shall be as manufactured by Carlon, An Indian Head Co., O.Z. Manufacturing Co., or equal.

5. Steel elbows and couplings shall be hot-dipped galvanized.

6. Conduit hubs shall be as manufactured by Myers Electric Products, Inc., Raco Div., O.Z. Manufacturing Co., or equal.

7. Conduit wall seals shall be Type WSK as manufactured by O.Z. Manufacturing, Co., or equal by Link Seal Co.

8. Combination expansion-deflection fittings shall be Type XD as manufactured by Crouse-Hinds Co., or equal by Appleton Electric Co., O.Z. Manufacturing Co.

9. Conduit seal bushings shall be Type CSB as manufactured by O.Z. Manufacturing Co., or equal by Crouse-Hinds Co.

10. Fire stops shall be Type CFSF as manufactured by O.Z. Manufacturing Co., or equal by Crouse-Hinds Co., Appleton Electric Co.

E. Conduit Mounting Equipment. Hangers, rods, backplates, beam clamps, etc. shall be hot-dipped galvanized iron or steel. Mounting equipment shall be as manufactured by B-Line Co., Thomas and Betts Co., Unistrut Corp., or equal.

F. Corrosion Protection for Galvanized Conduit. Corrosion protection for galvanized conduit shall be cold galvanized zinc based paint as manufactured by L.P.S. Co., Los Angeles, California, CRS Chemicals, Drecher, Pennsylvania, or equal.

PART 3 – EXECUTION

3.01 INSTALLATION

A. No conduit smaller than 3/4 inch electrical trade size shall be used, nor shall any have more than three 90 degree bends in any one run. Approved factory elbows shall be used when sharper bends are necessary. Pull boxes shall be provided as required or directed.

B. No wire shall be pulled until the conduit system is complete in all details; in the case of concealed work, until all rough plastering or masonry has been completed; in the case of exposed work, until the conduit system has been completed in every detail.

C. The ends of all conduits shall be tightly plugged to exclude dust and moisture while the buildings are under construction.

D. Conduit supports shall be spaced at intervals of eight feet or less, as required to obtain rigid construction.

E. Single conduits shall be supported by means of one-hole pipe clamps in combination with one-screw back plates, to raise conduits from the surface. Multiple runs of conduits shall be supported on trapeze type hangers with steel horizontal members and threaded hanger rods. The rods shall be not less than 3/8 inch diameter. Wire hangers will not be accepted.

F. Conduit hangers shall be attached to structural steel by means of beam or channel clamps. Where attached to concrete surfaces, concrete inserts of the spot type shall be provided.

G. All conduits on exposed work and concealed above hung ceilings shall be run at right angles to or parallel with surrounding wall and shall conform to the form of the ceiling. Diagonal runs will not be allowed. Bends in parallel conduit runs shall be concentric. All conduit shall be run perfectly straight and true.

H. Conduit terminating in pressed steel boxes shall have double locknuts and insulated bushings.

I. PVC conduits shall be installed using a fusing cement process. Conduits shall be water tight.

J. Conduit terminating in gasketed enclosures shall be terminated with conduit hubs.

K. Metallic heavy wall conduits shall be installed using threaded fittings. Threadless fittings may be used in isolated instances when approved by the Engineer.

L. Liquidtight flexible metal conduit shall be used for all motor terminations and other equipment where vibration is present.

M. When a conduit has to be cut in the field, it shall be cut square using a hand or power hacksaw cutter, or an approved pipe cutter using knives. The use of pipe cutter wheels will not be permitted. The cut ends of the field cut conduit shall be reamed to remove burrs and sharp edges. Where threads have to be cut on conduit, the threads shall have the same effective length and shall have the same thread dimensions and taper as specified for factory cut threads on conduits. Field cut threads shall be protected by a field applied cold galvanizing compound.

N. Conduits entering buildings below grade shall be furnished with a conduit seal bushing.

O. Concealed conduits in floor slabs and walls and encased in concrete envelope shall be run in direct line with bends of largest possible radius.

P. Ducts shall not be installed in slabs where the slab is below the highest known groundwater level.

Q. Where ducts terminate at panelboards, terminal cabinets, etc. panel of sufficient width and depth shall be provided to maintain the 2 inch spacing between ducts or wireways shall be provided below panels, cabinets, etc.

R. A ground wire shall be run in all runs of PVC conduit.

S. All bends in PVC conduit shall be made using a hotbox and bending guide tool.

T. Refer to “Conduit Embedded in Slabs” in SECTION 16050, ELECTRICAL GENERAL CONDITIONS.

U. Conduits run underground below the highest known ground water level shall not enter buildings below this groundwater level without first being run through a drain manhole, handhole, or exterior pull box.

END OF SECTION

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SECTION 16442

PANELBOARDS

PART 1 – GENERAL

1.01 DESCRIPTION:

A. The work of this section includes the furnishing and installing of all panelboards as specified herein and as shown on the drawings. All panelboards shall be provided with the applicable NEMA enclosure in accordance with the Electrical Contract Drawings.

1.02 SUBMITTALS:

A. Submit the following in accordance with Section 01300:

1. Panelboards, including construction details and enclosures
2. Terminals and lugs
3. Trim
4. Buses
5. Circuit Breakers
6. Groundfault Circuit Interrupter
7. Metering

1.03 DELIVERY, STORAGE AND HANDLING:

A. Provide in accordance with Section 01600.

B. All materials shall be shipped, stored, handled and installed in such a manner as not to degrade quality, serviceability, or appearance.

1.04 DESIGN CRITERIA:

A. Panelboard ratings shall be as shown on the drawings. All panelboards shall be rated for the intended voltage.

B. Panelboards shall be in accordance with the Underwriter Laboratories, Inc. “Standard for Panelboards” and “Standard for Cabinets and Boxes” and shall be so labeled where procedures exist. Panelboards shall also comply with NEMA Standard for Panelboards and the National Electrical Code.

PART 2 – PRODUCTS

2.01 PANELBOARD CONSTRUCTION:

A. Interiors

1. All interiors shall be completely factory assembled with circuit breakers, wire connectors, and buses. All wire connectors, except screw terminals, shall be of

the anti-turn solderless type and all shall be suitable for copper wire of the sizes indicated.

2. Interiors shall be designed such that circuit breakers can be replaced without disturbing adjacent units and without removing the main bus connectors and shall be such that circuits may be changed without machining, drilling or tapping.

3. Branch circuits shall be arranged using double row construction except when narrow column panels are indicated. Branch circuits shall be numbered by the manufacturer.

4. A factory provided label shall be provided listing panel type, number of circuit breakers and ratings.

5. The main breaker shall be at the top or bottom of the bus construction and not a branch breaker.

B. Buses

1. Main bus shall be copper. Full size neutral bars shall be included. Phase bussing shall be full height without reduction. Cross connectors shall be copper. All buses shall be tinned.

2. Main bus shall be distribution phase sequence type configuration to allow installation of two or three pole circuit breakers at any location.

3. Neutral bussing shall have a suitable lug for each outgoing feeder requiring a neutral connection.

4. Spaces for future circuit breakers shall be bussed for the maximum device that can be fitted into them.

5. Solderless main lugs or main circuit breakers shall be furnished as shown on the drawings.

6. Bus bracing to be at least equal to the interrupting rating of lowest rated circuit breaker installed in panel. Series rated breakers and panels shall not be acceptable.

C. Boxes

1. Recessed boxes shall be made from galvanized code gauge steel having multiple knockouts unless otherwise noted. Surface mounted boxes shall be painted to match the trim. Boxes shall be of sufficient size to provide a minimum gutter space of four inches on all sides.

2. Surface mounted boxes shall have an internal and external finish as specified herein. Surface mounted boxes shall be field punched for conduit entrances.

3. At least four interior mounting studs shall be provided.

4. Panelboards shall be "door-in-door" construction.

D. Trim

1. Hinged door-in-door construction shall enclose all circuit breaker handles and shall be included in all panel trims.

2. Doors shall have semi flush type cylinder lock and catch, except that doors over 48 inch in height shall have a vault handle and three point catch, complete with lock, arranged to fasten door at top, bottom and center. Door hinges shall be concealed. Two keys shall be supplied for each lock. All locks shall be keyed alike. A directory frame and card having a transparent cover shall be furnished on each door.

3. Trims shall be fabricated from code gauge sheet steel.

4. All exterior and interior steel surfaces of NEMA 1, 1A, 3R and 12 panelboards shall be properly cleaned and finished with ANSI Z55.1, No. 61 light gray paint over a rust-inhibiting phosphatized coating. The finish paint shall be of a type to which field applied paint will adhere.

5. Trims for flush panels shall overlap the box by at least 3/4 inch all around. Surface trims shall have the same width and height as the box. Trims shall be fastened with quarter turn clamps.

E. Manufacturer

1. 208 Volt, three phase, 4 wire panelboards shall be type NF Series as manufactured by the Square D, equal by General Electric, or Siemens.

2. 480 Volt, three phase, 3 or 4 wire distribution panelboards shall be type I-Line Series as manufactured by the Square D, equal by General Electric, or Siemens.

2.02 CIRCUIT BREAKERS:

A. Panelboards shall be equipped with circuit breakers with frame size and trip settings as shown on the drawings. Circuit breaker mounting shall not exceed 78 inches above floor.

B. Circuit breakers shall be molded case, bolt-in type.

C. Circuit breakers installed in 120/240 Volt and 120/208 Volt panelboards shall have an interrupting capacity of not less than 10,000 Amperes, RMS symmetrical.

D. Circuit breakers installed in 277/480 Volt panelboards shall have an interrupting capacity as shown on the Electrical Contract Drawings.

E. Main circuit breaker shall be attached to the main vertical bus.

2.03 GROUND FAULT CIRCUIT INTERRUPTER (GFCI):

A. GFCI shall be provided for circuits where indicated on the drawings. GFCI units shall be molded case, bolt-on breakers, incorporating a solid state ground fault interrupter circuit insulated and isolated from the breaker mechanism. The unit shall be U.L. listed Class A Group I device (5 milliamp sensitivity, 25 millisecond trip time), and an interrupting capacity matching the circuit breakers in the panelboards.

2.04 DIGITAL POWER METER

A. Main Distribution panelboard shall be metered with a digital power meter.

B. Digital Power Meter

1 Digital power meter shall be true RMS type power monitor with features to data log (30 days) and communicate remotely the AC amperes on each phase, voltage, harmonic distortion, watts, volt amperes, bars, power factor, frequency, demand watts, demand volt ampere and watt hours; and capable of providing alarm status for phase loss, phase on balance, phase reversal and provides all data to remote monitoring systems.

2. The power meter shall communicate using Modbus TCP via an Ethernet RJ-45 port and be able connect to any host devices.

C. Provide small control wiring, necessary fuse blocks, suitable numbering strips and terminal blocks as required

D. Provide current transformers for each meter. Current transformers shall be wired to shorting type terminal blocks. All transformers used for metering shall meet the requirements of IEEE C12.11 and IEEE C57.13.

PART 3 – EXECUTION

3.01 INSTALLATION:

A. Boxes for surface mounted panelboards shall be mounted so there is at least ½ inch air space between the box and the wall.

B. Circuit directories shall be typed identifying location and nature of load served.

C. Panelboards installed in areas with finished walls shall be installed recessed into the wall with the front of the panel flush with the finished wall.

- END OF SECTION -

SECTION 16495

VARIABLE FREQUENCY DRIVES

PART 1 – GENERAL

1.01 DESCRIPTION

A. The work of this section includes furnishing all labor, materials, tools and equipment necessary to furnish and install Variable Frequency Drives (VFD) as shown on drawings, specified herein, or evidently required to complete the work.

B. Refer to various DIVISION 11 – EQUIPMENT sections and contract drawing motor wiring diagrams for field device interface.

1.02 SUBMITTALS

A. Shop Drawings and/or brochures shall be submitted to the Engineer in accordance with Section 01300.

B. Submittals required under this section include, but are not limited to the following:

1. Shop drawings showing complete fabrication and construction details, materials, electrical components, enclosures, input line reactors, harmonic filters, weights, dimensions, clearances, anchorage locations, piping and utility requirements, and step by step sequence of controls.

2. Certified Performance and Efficiency Characteristics.

3. The Contractor shall provide the VFD manufacturer with copies of all motor shop drawing submittals and or nameplate data. The VFD manufacturer shall review this data and shall certify in writing that the equipment has been coordinated with the variable frequency drives and motors for complete compatibility.

4. Harmonic Analysis and written summary report.

5. Complete master wiring diagrams, VFD layout drawings and control schematics, including required coordination with other electrical control devices operating in conjunction with each VFD and suitable outline drawings shall be furnished for each VFD being supplied for approval before proceeding with manufacture. Due to the complexity of the control functions, it is imperative the above drawings be clear and carefully prepared to facilitate interconnections with other equipment. Standard preprinted sheets or drawings simply marked to indicate applicability to this contract will not be acceptable.

1.03 DELIVERY, STORAGE AND HANDLING

A. All materials and equipment shall be shipped, stored, and handled in accordance with Section 01600.

B. The materials and components shall be stored on a flat, clean surface to prevent damage and shall be covered to prevent exposure to adverse conditions prior to installation.

C. All materials shall be shipped, stored, handled and installed in such a manner as not to degrade quality, serviceability, or appearance.

1.04 DESIGN CRITERIA

A. The materials and equipment covered by this specification are intended to be standard materials and equipment of demonstrated successful performance, as manufactured by reputable concerns. Equipment shall be designed and constructed in accordance with the highest standards of the industry and shall be installed in accordance with the manufacturer's recommendations and the Contract Documents. The specifications call attention to certain features but do not purport to cover all details entering into the construction of the equipment.

C. Provide individual constant torque VFD's with LCL line filter and low harmonic drives. Each individual VFD requires all these devices to be factory mounted within its enclosure. Field mounting of drive related accessories is unacceptable.

D. All equipment submitted shall be provided with enclosures that can be installed in the spaces shown on the drawings. Enclosures that exceed the allowable space provided shall be subject to rejection.

E. Heat dissipation from VFD enclosures shall meet all requirements of the specifications.

F. All VFDs shall be low harmonic drives for the wastewater and water industry meeting the requirements of IEEE-519 as manufactured by ABB, General Electric or Schneider Electric.

G. Each VFD unit shall be U.L. listed or labeled.

1.05 HARMONIC REQUIREMENTS

A. Under normal operating conditions, the line harmonics introduced into the power system from the AC VFD unit(s) shall be within the distortion limits as defined in IEEE 519 and less than %5 Ithd. The point of common coupling shall be the main distribution panel.

PART 2 – PRODUCTS

2.01 DRIVES

A. This specification is intended to outline the overall physical features, performance and functional requirements of the VFD equipment required under this section, consisting of a variable speed adjustable frequency converter, by-pass contactor, filters, accessories,

and enclosure. The VFD system shall be fully tested by the manufacturer before initial startup with all components compatible in function and appearance.

B. Variable Speed Adjustable Frequency Converter. The adjustable frequency drive shall be UL Listed solid state type in a NEMA 12 filtered enclosure and blower cooled. The filter element shall be of the removable and replaceable type for each drive unit. Front access shall be provided. Top, rear and side access shall not be required. The enclosure shall be coated with an epoxy resin base and acrylic resin enamel finish. The drive shall meet applicable provisions of DIVISION 16, ELECTRICAL, the National Electric Code and NEMA. The drive shall be arranged for 480 Volts plus 10 percent to minus 5 percent, three phase, 57 to 63 Hertz input converted into adjustable frequency/Voltage output in an ambient temperature of -10 to 40 degrees C. The VFD shall be capable of sustaining operation with a line voltage dip of 15 percent of normal operating voltage on a constant torque or variable torque load. During line dip the VFD shall automatically provide a speed drop allowing maximum capable speed for the duration of the input voltage dip. Each individual drive shall be mounted in a separate enclosure. The drive efficiency shall be 97 percent or better at full speed and full load. Fundamental power factor shall be 0.98 at all speeds and loads. Each individual drive and associated equipment shall be mounted in a single and individual enclosure unless otherwise specified. The following features shall be included with each adjustable frequency drive:

1. Control. The control method shall be sinusoidal Pulse Width Modulation. Output Voltage shall be three phase, 480 Volts and output frequency shall be 0.1 to 66 Hz when shipped. Frequency shall be selectable by a digital keypad. The frequency resolution shall be 0.1 Hz and the accuracy shall be within 1.0 percent of the maximum frequency at 25 degrees plus or minus 10 degrees C. Voltage/frequency (V/f) characteristics shall be characterized by selectable patterns. Up to 82 control functions shall be programmed. The overload capacity shall be 110 percnet continuous and a minimum two minute rating of 150 percent of rated current. The frequency setting signal shall be 4 to 20 mA. The VFD shall employ a full wave rectifier to prevent input line notching, DC bus choke, DC bus capacitors, and Insulated Gate Biplar Transistors (IGBT's) as the output switching device. SCRs, GTOs and Darlington transistors are not acceptable.

2. Function. The adjustable parameters consisting of: accelerating time, decelerating time, upper and lower limit of output frequency, and 4 to 20 mA reference bias and reference gain shall be indicated on a digital display. Braking shall be achieved through capacitor charging and starting shall be achieved by external contact. The VFD shall be software configurable to automatically restart following power outage, overcurrent and overvoltage detection. Soft stall shall occur when motor runs continuously at overload.

3. Protection. The drive shall be protected from stalling, overcurrent, overload, short circuit, overvoltage, undervoltage, loss of one (1) phase of input power, instantaneous power failure (approximately 30 msec), overheating, fuse burnout protection and earth (ground) fault detection. The fault cause shall be displayed (flickering) for overcurrent, short circuit, overload, overvoltage, overheating and earth (ground) fault. There shall be a main capacitor charging indicator for

internal circuit. Fault shall be reset by a reset push button on the printed circuit board and an external reset contact.

4. Displays. The digital display shall be a 2 line, 40 character unit with readout in plain English. A separate LED indicator shall be provided for capacitor charge. Display shall be located on the door of the VFD enclosure.

5. Internally mounted set point control shall be provided to receive either a 4 to 20 mAdc analog input control signal from a process panel to control the speed of the motor. An external digital display shall be provided outside of the inverter. The following control devices shall be available for external control of the inverter; frequency/speed meter, frequency setting variable resistor, knob for frequency setting variable resistor and drive switch.

6. A lockable main load break disconnect switch interlocked with the enclosure door with through the door handle to provide positive disconnect of incoming AC power shall be furnished for each individual drive and enclosure. The circuit breaker shall be rated at a minimum 25,000 amperes at 480 volts, RMS symmetrical.

7. Each drive shall be provided with the following accessories:

    a. “Local-Off-Remote” keypad switch for local/remote speed control. In the "Remote" mode, the motor speed shall be adjusted in response to the related remote 4 to 20 mA pacing signal. In “Local” mode the motor speed shall be adjusted in response to keypad entry speed and the VFD shall run when the “Hand-Off-Auto” selector switch is in “HAND". . In “Off” mode the VFD shall not run.

    b. Provide a 4-20 mA speed feedback output signal.

    c. Provide four (4) Type C dry contacts at each VFD for remote indication of motor running status.

    d. “Hand-Off-Auto” selector switch located on the door of the VFD enclosure. In the “Auto” position the VFD shall be started and stopped remote via an external dry contact. In the “Hand” position the VFD shall run. In “Off” mode the VFD shall not run.

    e. Elapsed time meters located on the door of the VFD enclosure.

    f. Provide two (2) type C contacts at each VFD for remote indication of VFD run and fault conditions.

    g. Motor running indicating light located on the door of the VFD enclosure.

    h. Motor off indicating light located on the door of the VFD enclosure.

    i. Drive failure indicating light located on the door of the VFD enclosure.

j. All VFD enclosure mounted indication lights shall be LED push to test type.

k. All time delay relays shall be true on and true off type that utilize the control signal for relay power.

l. Provide all controls and accessories as shown on the equipment motor wiring diagrams in the contract drawings. Specialized interface relays supplied by the equipment manufacture shall be installed in the VFD cabinet by the VFD manufacture at the VFD manufacturing plant. Coordinate with the equipment manufacture for space requirements and delivery of the relays.

PART 3 – EXECUTION

3.01 VERIFICATION OF CONDITIONS

A. Before the start of the work of this Section, verify that the project is ready for this work.

B. Verify that field measurements are as shown on approved shop drawings and/or manufacturer's instructions.

C. Verify that the equipment or material is in conformance with the approved shop drawings and specifications and resolve any deviations.

3.02 INSTALLATION

A. All materials and equipment shall be installed in a neat, workmanlike manner.

B. Minimum requirements of all wiring of the equipment shall be as specified under DIVISION 16 -ELECTRICAL of these specifications.

C. Installation of the equipment shall be in accordance with written instructions provided by the manufacturer and as approved.

3.03 PAINTING

A. Shop painting and the surface preparation is a part of the work specified herein. Enclosures shall be coated with an electrostatically-applied epoxy enamel.

3.04 CLEAN UP

A. Prior to start-up and field testing, all foreign matter shall be removed from the equipment. Spillage of lubricants used in servicing the system shall be cleaned from all equipment and concrete surfaces.

3.05 MANUFACTURER'S FIELD SERVICES

A. Manufacturer's Field Services shall be provided for field programming and startup for all the VFDs provided.

3.06 MANUFACTURER'S TRAINING

A. Manufacturer's training shall be provided for training of Owner's personnel for each type of VFD provided in accordance with Section 01700.

C. Manufacturer's Training of Owner's Personnel shall be a minimum of two (2) calendar days performed at the project site.

3.07 SPARE PARTS

A. One (1) complete spare Pump VFD with enclosure identical to the VFDs being provided for the pumps.

B. One (1) indication light of each color being utilized

C. Three (3) fuses of each size being utilized.

3.08 WARRANTY

A. A manufactures warranty for three years shall be provided for each VFD.

- END OF SECTION -

SECTION 16500

LIGHTING SYSTEMS

PART 1 – GENERAL

1.01 DESCRIPTON:

A. The work of this section includes the furnishing and installing of complete lighting systems including panelboards, transformers, lighting fixtures, receptacles, switches, contactors, clocks and all accessories and appurtenances required as specified herein and as shown on the drawings.

1.02 SUBMITTALS:

A. Submit the following in accordance with Section 01300:

1. Light Switches
2. Receptacles
3. Lighting Fixtures
4. Lamps
5 Ballasts
6. Device Plates
7. Emergency Lighting Battery Units and Exit Lights

1.03 DELIVERY, STORAGE AND HANDLING

A. Provide in accordance with Section 01600.

B. All materials shall be shipped, stored, handled and installed in such a manner as not to degrade quality, serviceability, or appearance.

1.04 DESIGN CRITERIA:

A. All lighting fixtures shall be in accordance with the National Electrical Code and shall be constructed in accordance with the Underwriters Laboratories "Standards for Safety, Electric Lighting Fixtures." All lighting fixtures shall be Underwriters Laboratories labeled.

PART 2 – PRODUCTS

2.01 WIRE:

A. Wire shall be as specified under Section 16120, Wire and Cables.

2.02 CONDUIT:

A. Conduit shall be as specified under Section 16130, Raceways and Fittings.

2.03 PANELBOARDS:

A. Panelboards shall be as specified under Section 16442, Panelboards.

2.04 LIGHT SWITCHES:

A. NEMA WD 1, UL 20, Heavy-Duty, AC only general-use toggle switch.

B. Rated 20 Amperes, 120/277 Volts for inductive and resistive loads.

C. Motor rated up to 80 percent of ampere rating.

D. Totally enclosed in a phenolic base and cover.

E. U.L. and CSA Listed.

2.05 RECEPTACLES:

A. NEMA WD 1, UL 498, Heavy-duty general use receptacle.

B. GFCI Receptacle: UL 943, Convenience receptacle with integral ground fault circuit interrupter and indication light that is lighted when device is not tripped.

C. NEMA WD 6, straight blade type for rated current and phases as indicated on drawings.

D. Weatherproof Cover Plate: NEMA 3R, black thermoplastic while use type covers by Hubbell or equal.

2.06 DEVICE PLATES AND COLORS:

A. For interior work devices shall be white and device plates for shall be of the required number of gangs for the application involved and shall be Type 302 (18-8) high nickel stainless steel of the same manufacturer as the device.

B. For exterior work devices shall be black.

2.07 LIGHTING FIXTURES:

A. Lighting fixture shall be LED illuminated and of type as shown on the drawings. The catalog numbers listed are given as a guide to the design and quality of fixture desired. Equivalent designs and equal quality fixtures of other manufacturers will be acceptable.

B. The fixture shall be tested to IESNA LM-79-08 and LM-80 Testing Standards at 25° C ambient temperature

C. The LED package shall be designed around the lumen maintenance of 87% at 60,000 hrs. and is to be expected to achieve L70 at 100,000 hrs.

D. The Light Engine shall be a high efficacy LED light engine equipped with brand-name LEDs available in outputs of 100%, 85%, 70% and 55%.

E. The LED Drivers shall be Electronic Class 2, high efficiency, with the following power factor correction (PFC):

1. Standard Non-Dimming Driver (PFC>0.95).

2. Dimming Drivers (PFC>0.90).

2.09 EMERGENCY LIGHTING BATTERY UNITS AND EXIT SIGNS:

A. Emergency lighting units shall be fully automatic with 12 Volt nickel cadmium batteries. The wattage of the unit shall be sufficient to power the remote lamps as shown on the Contract Drawings, plus 20% spare capacity, for 1-1/2 hour upon loss of AC power. Units shall be designed for 120 Volt, 60 Hertz input and have an automatic clock timer and solid state charger, ready/off switch, press-to-test switch, amber "ready" light, red "charge" light and required number of supervisory relays.

B. Provide Holophane DeSoto M802 series emergency lighting units with dual lighting heads. Units manufactured by Hubbell, Dual Lite or approved equal are also acceptable. Lighting heads shall be 12 volts, 20 watts, halogen type.

C. Provide Holophane QM-LED series exit signs with LED lamps, nickel cadmium battery, and battery charger. White background with red lettering. Equivalent units manufactured by Dual Lite, Sure Lite or approved equal are acceptable.

D. In NEMA 1, 12, 4, and 4x areas, provide remote wall mounted lamp heads ELA-DM802 sealed thermoplastic, 12 volts, 12 watts, halogen type with weatherproof mounting base by Holophane. Equivalent units manufactured by Hubbell, Dual Lite or approved equal are acceptable.

PART 3 – EXECUTION

3.01 INSTALLATION:

A. Each fixture shall be a completely finished unit with all components, mounting and/or hanging devices necessary, for the proper installation of the particular fixture in its designated location and shall be completely wired ready for Connection to the branch circuit wires at the outlet. All pendant mounted fixtures shall be mounted plumb with floors and walls.

B. When fixtures are noted to be installed flush, they shall be complete with the proper accessories for installing in the particular ceiling involved. All flush mounted fixtures shall be supported from the structure and shall not be dependent on the hung ceilings for their support.

C. Flexible fixture hangers shall be used for all pendant mounted fixtures. Pendant mounted fixtures shall be supported from 3/4 inch galvanized rigid steel conduit.

D. Receptacles and switches shall be mounted at 45” above finished floor.

E. Mounting heights given are to the bottom of the fixture. When “mount up” is indicated, fixture is to be mounted the stated distance off the finished floor.

3.02 CLEANING UP:

A. All fixtures shall be left in a clean condition, free of dirt and defects, before acceptance by the Engineer.

- END OF SECTION -

SECTION 16612

ENGINE GENERATOR

PART 1 – GENERAL

1.01 DESCRIPTION:

A. The work of this section includes all labor, materials, tools, equipment and incidentals necessary to furnish and install, put in operation and field test quantity a diesel engine driven generator unit with sound attenuated weatherproof enclosure and doubled wall base tank of the size and rating as specified herein and on the Drawings.

1.02 SUBMITTALS:

A. Shop Drawings and/or brochures shall be submitted to the Engineer in accordance with Section 01300.

B. Submit all pertinent technical data including but not limited, to the following:

1. Manufacturer and model of engine and generator

2. Rated capacity B.H.P.

3. Generator

4. Generator KVA, KW and P.F. rating

5. Voltage

6. Class insulation

7. Temperature rise above 40 degree C ambient

8. Generator efficiency and fuel consumption at full load, 3/4 load and l/2 load

9. Operating weight of complete unit

10. Exhaust piping

11. Double walled base tank

12. Battery and charger

13. Auxiliary system power requirements and wiring diagrams

14. Enclosure with all conduit openings for system operation identified.

C. Manufacturer's certified test record. The test record shall show the generator performance and frequency regulation to satisfy the requirements specified herein, and shall also show fuel consumption rates at 1/2 load, 3/4 load and full rated load.

D. Submit all other data specified in this section and as outlined in Section 01300.

1.03 DELIVERY, STORAGE AND HANDLING

A. Provide in accordance with Section 01600.

B. All materials shall be shipped, stored, handled and installed in such a manner as not to degrade quality, serviceability, or appearance.

1.04 DESIGN CRITERIA:

A. The engine generator unit shall comply with the requirements of the Federal Environmental Protection Agency and State of Massachusetts Department of Environmental Protection.

B. The engine generator unit shall be arranged for automatic starting and stopping on failure of, and restoration of the normal source of power, and for automatic load transfer, but not including the automatic load transfer switch which will be furnished separately.

C. The engine generator unit shall include, but not be limited to excitation system, controls, keep warm system, cooling system, silencer, starting batteries, charger, and all essential and desirable appurtenances whether specifically mentioned in this specification or not.

D. The system described herein, including but not necessarily limited to the engine generator set, engine auxiliaries, batteries and engine generator control panels shall be furnished by a single supplier who is regularly engaged in the production of diesel fueled engine driven generators.

E. The voltage regulation shall be within plus or minus two percent from no load to full rated load. On application or removal of full rated load in one step, the transient voltage dip or overshoot shall not exceed twenty percent of rated voltage. Frequency regulation shall be within 3 Hertz from no load to full load.

F. The voltage regulator shall be insensitive to severe load induced waveshape distortion from SCR or thyrister circuits such as those used in battery charging (UPS) and motor speed control equipment. This SCR immune regulator shall not reduce the motor starting capabilities as specified herein.

G. Engine generator units of not less than KW rating indicated on the contract drawings, 0.8 power factor capacity with 3 phase, 60 Hertz, 480/277 Volts, 4 wire alternating current generator shall be furnished.

H. The engine generator units shall be completely prewired and piped so that only field connections to a master terminal strip for control, auxiliaries and alarms, and power connections to a molded case line circuit breaker and fuel fill and vent line connections will be required.

I. The engine generator unit and associated auxiliaries systems and components shall be skid mounted and installed outdoors.

1.05 QUALIFICATIONS:

A. The generator units shall be the standard product, as modified by these Specifications, of one of the following manufacturer listed below. Engine generator unit shall be a standard production model of proven ability and shall be designed, constructed, and installed in accordance with the best practice and methods. In addition, the manufacturer shall maintain a permanent service organization and supply of spare parts as necessary to provide adequate service within 60 miles of the site. The design basis for the generator size including the enclosure and base tank are based on a Kohler unit with dimensions of 28’ Length, 6.5’ Width, 11.5’ Height. Due to constraints on the site, units by the other manufactures must not exceed these dimension of by more than 10% which may require custom fabricated enclosures by the manufacture.

1. Caterpillar

2. Cummins

3. Kohler

B. The engine generators shall be a factory assembled unit specifically designed and fitted for operation on diesel fuel. The engine generator unit shall be free from injurious torsional or other vibration, and shall be assembled on an adequate steel subbase suitable for mounting on vibration isolation pads, on a flat concrete surface which is suitable for supporting the weight of the unit. The vibration installation material shall be furnished with the engine generator unit.

C. The engine generator unit will be installed in Taunton, MA and rated for use at this location’s elevation level. Outdoor enclosed units shall be provided with heating and cooling as required to maintain the generator set operational within the temperature limits of all devices and equipment. The engine generator unit shall be suitable for continuous operation at any temperature between 0 and 110 degree F at its full load rating and at 80 percent power factor.

D. The engine generator unit shall be designed and built in accordance with the latest standards of IEEE, NEMA, ANSI and ASME.

E. The engine generator unit shall be designed to minimize the danger of accidents to operating and maintenance personnel. The manufacturer shall, prior to shipment, verify that all electrical connections are tight and that circuits are isolated, that on-set piping connections are well-made, and that standard safety equipment is included and functions according to design.

1.06 ENGINE GENERATOR UNIT PERFORMANCE:

A. The engine generator unit shall maintain rated frequency from no load to full rated load.

B. The voltage regulation shall be as specified herein and recovery to steady state operation shall be within two seconds.

C. Stable or steady state operation is defined as operation with terminal voltage remaining constant within plus or minus one percent of rated voltage. A rheostat shall provide a minimum of plus or minus five percent voltage adjustment from rated voltage.

D. Frequency regulation shall be maintained within 2½ percent of rated frequency from no load to full load. The steady state frequency shall be within 0.5 percent of rated frequency.

E. The engine shall be equipped with a electronic isochronous governor capable of maintaining the engine speed from no load to full load within plus or minus .25 percent of the synchronous speed.

1.07 PRODUCT HANDLING:

A. All materials shall be shipped, stored, handled and installed in such a manner as not to degrade quality, serviceability, or appearance.

B. Protect material and equipment, in accordance with the manufacturers recommended storage procedures, before, during, and after installation. Stored items shall be protected from the weather and contamination. During installation, piping and similar openings shall be capped to keep out dirt and other foreign matter.

1.08 WARRANTY/SERVICE:

A. The manufacturer's and dealers Extended Service Coverage shall in no event be for a period of less than five (5) years from date of Owner/Engineer's acceptance of the system and shall include repair parts, labor, travel expense necessary for repairs at the jobsite, and expendables (lubricating oil, filters, antifreeze, and other service items made unusable by the defect) used during the course of maintenance and repair. Applicable deductible costs applying only after the first year shall be specified in the manufacturer's warranty and not exceed $500 per site visit. Submittals received without written warranties as specified will be rejected in their entirety. Warranty and maintenance shall be issued and executed by the dealer and may not be subcontracted.

B. The generator set supplier shall have factory trained service representatives and tooling necessary to install, test maintain, and repair all provided equipment and shall be located within 150 miles of the customer's site.

PART 2 – PRODUCTS

2.01 ENGINE:

A. The engine shall be diesel fueled, four (4) cycle, water-cooled, while operating with nominal speed not exceeding 1800 RPM. The engine shall meet applicable EPA non-road mobile regulations and/or the EPA NSPS rule for stationary reciprocating compression ignition engines. Additionally, the engine shall comply with the State and Federal emission regulations at the time of installation/commissioning. Actual engine

emissions values must be in compliance with applicable EPA emissions standards per ISO 8178 Emissions Cycle at specified ekW/bHP rating.

B. The engine shall be furnished with thermostatically controlled jacket water heaters of the size recommended by the supplier. Heaters shall be rated for operation on 120 Volts.

C. The oil sump will be fitted with pipe nipples, a ball valve, and an extension oil drain.

D. The engine shall be provided with a governor which maintains the frequency within a bandwidth of the rated frequency, over a steady-state load range of zero to 100% of rated output capacity. The governor shall be configured for safe manual adjustment of the speed/frequency during operation of the engine-generator set, without special tools, from 90 to 110% of the rated speed/frequency, over a steady state load range of 0 to 110% or rated capacity.

1. Steady state speed band, +/- 0.25% of rated speed.

2. Internal oil pump, relief valve and accumulator controls governor operating pressure.

3. Manual speed adjustment knob at top of unit.

4. Positive locking to allow manual speed adjustment.

2.02 COOLING SYSTEM:

A. The engine shall be furnished with a unit mounted radiator. The radiator shall be of sufficient size to cool the water when ambient temperature is 100 degrees F. and the engine generator unit is operating at full rated load continuously.

B. Cooling system shall further include water cooled manifolds, pusher fans and high temperature cutout. Provide radiator duct connector complete with suitable gasket, bolts and nuts. The cooling system shall be furnished with sufficient antifreeze solution to protect the cooling system with ambient air temperature down to minus fifty degrees F.

C. Provide an anti-freeze treatment as recommended by the manufacturer for protection against corrosion and scale formation. The anti-freeze treatment shall be compatible with the antifreeze solution. The anti-freeze will be long life environmentally friendly polypropylene glycol. The concentration will be as recommended by the manufacturer.

2.03 FUEL SYSTEM:

A. The engine shall be furnished with filter, fuel pressure gage and engine priming pump.

B. The engine-generator unit shall be furnished with an approximate 36 inch high, double-walled fuel base-tank with leak detection and fuel capacity for 48 hours of generator operation at full load. Tank shall be constructed of heavy gauge steel; epoxy coated interior, and rust proofed and finish painted exterior.

1. Tank shall conform to NFPA 30 and NFPA 47.

2. The diesel fuel oil tank shall have tappings for fuel supply and return. It shall be equipped with a suitable vent cap. The fill pipe shall be extended to the exterior wall and easily accessible and lockable.

3. The tank shall be dual wall constructed of steel and mounted directly to the generator set skid, and shall be provided with low fuel and leak detection alarms and dry contacts. For added protection the rupture basin portion of the tank shall have a leak monitoring system utilizing a non-toxic, non-volatile liquid to determine integrity of external rupture basin wall. This shall be coordinated to operate with floats and sensors of the fuel tank.

4. An 8 gallon overflow tank shall be furnished at the generator fill. The generator shall be furnished with a 2 inch diesel vent fuel line. The diesel fuel tank shall be furnished with audible and visual alarms at the fill gauge.

5. Vent and overflow piping to be provided.

6. Fuel gauge.

7. Provide tank openings to allow manual level measurement with stick gauges.

2.04 EXHAUST SILENCER:

A. The engine generator unit shall be provided with a critical type silencer including flexible exhaust fittings. Silencers shall be mounted so that its weight is not supported by the engine. Exhaust piping shall be sized as recommended by the manufacturer. Connection between engine and silencer shall be of the stainless steel flexible type.

B. Silencers shall be Maxim MT41 equal by Kitell, or equal for turbocharged engines.

C. A flexible section shall be provided at each engine and an expansion joint at each muffler. Flexible sections and expansion joints shall have flanged connections. Flexible sections shall be made of convoluted seamless tube without joints or packing. Expansion joints shall be the bellows type. Expansion and flexible elements shall be stainless steel suitable for diesel-engine exhaust gas at the maximum exhaust temperature that is specified by the engine manufacturer. Expansion and flexible elements shall be capable of absorbing vibration from the engine and compensation for thermal expansion and contraction.

D. Horizontal sections of exhaust piping shall be sloped downward away from the engine to a drip leg for collection of condensate with drain valve and cap. Changes in direction shall be long radius. Exhaust piping, mufflers and silencers installed shall be insulated with 3 inches of calcium silicate insulation and covered with aluminum flashing to protect personnel.

E. All portions of the exhaust system shall be insulated and covered with flashing.

2.05 STARTING SYSTEM:

A. The electric starting system shall consist of the following equipment:

1. The engine shall have a two wire, direct current starter suitable for automatic starting through the load transfer switch.

2. Batteries shall be of the lead-acid type. Batteries shall be guaranteed to have sufficient capacity when in a fully charged state to perform not less than five, 15 second cranks while in an ambient temperature of 0 degrees F without recharging.

3. Current limiting type automatic battery charger conforming to UL 1236 shall be of the static type, magnetic amplifier control with D.C. voltmeter, D.C. ammeter and potentiometer for voltage adjustment. Charger to be completely automatic, charging rate to be determined by the state of the battery, and reducing to milliamp current on a fully charged battery. Charger shall be for 120 Volt, single phase, 60 Hertz A.C. input with an output of not less than 10 amperes. The charger shall be for the correct voltage for the battery, and specifically for charging a lead-acid battery and for panel mounting. The charger shall be furnished with a battery under-voltage alarm system consisting of dry contacts for remote use.

2.06 ALTERNATOR:

A. The alternator shall be single bearing, open, dripproof revolving field, four pole brushless type, permanently aligned to the engine by flexible disc coupling. Each unit shall be reconnectable type having nine leads and shall be factory connected for three phase, 4 wire, 60 Hertz. The rating of the unit shall be as indicated on the drawings.

B. Alternators shall have Class F insulation and shall be furnished with Amortisseur windings. Alternators shall have a complete static automatic voltage regulator which will hold the voltage within plus or minus two percent from no load to full rated load. On application of rated load in one step, the transient voltage dip shall not exceed twenty percent. The generator windings shall be braced to withstand any possible short circuit stresses. Alternator shall be “Radio Interference Proof” (RIP) and “Telephone Influence Factor” (TIF) and shall be within the limits of Section 9, ANSI C50.12. Alternators shall have a rotating brushless exciter and rectifier.

C. The alternator characteristics shall be matched to the torque characteristics of the engine in such a manner that with full load connected to the alternator terminals, the alternator will utilize all the available engine power without exceeding it at all speeds.

D. The generator exciter shall be of the brushless type. Semiconductor rectifiers shall have a minimum safety factor of 300% for peak inverse voltage and forward current ratings for all operating conditions, including 110% generator output at 40 degrees C 104 degrees F ambient. The exciter and regulator in combination shall maintain generator-output voltage within the limits specified.

E. Each generator shall be provided with a solid-state voltage regulator, separate from the exciter. The regulator shall maintain the voltage within a bandwidth of the rated voltage, over a steady-state load range of zero to 100% of rated output capacity. Regulator shall be configured for safe manual adjustment of the engine-generator voltage output without special tools, during operation, from 90 to 110% of the rated voltage over the steady state load range of 0 to 100% of rated output capacity. Regulation drift shall not exceed plus or minus 0.5% for an ambient temperature change of 20 degrees C. 68 degrees F.

F. Alternators shall be furnished with 120V stator heater and controls.

2.07 CONTROLS:

A. The engine generator unit shall be furnished with a shock resistant, engine mounted microprocessor control panel with LCD display mounted in a NEMA 1 enclosure, dead front, with removable top panel.

B. The control panel shall have Modbus communication over Ethernet connection for remote system data monitoring by third party systems.

C. The following standard data shall be indicated from the LCD display and be available via the Modbus communications connection:

1. Jacket water temperature

2. Lube oil temperature

3. Lube oil pressure

4. Battery voltage

5. RPM

6. A.C. Voltmeter

7. A.C. Ammeter

8. Frequency meter

9. Elapsed time meter calibrated in hours and tenths of hours

D. Accessories shall include:

1. Current transformers.

2. Fuses

3. Generator voltage regulator

4. Voltage adjusting rheostat.

5. Fault indication lights one each for:

    a. low oil pressure
    b. high water temperature
    c. overspeed
    d. overcrank (fail to start).

6. Prewarn indication lights one each for:

    a. low oil pressure
    b. high water temperature.

7. 90 DB (a) Audible alarm to sound on any fault or prewarn and an alarm silencer.

8. Mode selector switch – "AUTO", "OFF", "MANUAL" with audible alarm when switch is not in "AUTO" position.

9. Control power fuse.

10. Fixed overcrank timer - four-10 second cranks shall be provided. After four cranks, the unit shall stop and an alarm initiated.

11. Auxiliary contacts which close when engine is in operation. Contacts shall be rated 10 amperes and shall be used to interlock combustion and ventilation air dampers.

12. Common failure relay

13. Dry contact kit with the minimum following contact signals:

    a. Engine Running
    b. Engine Trouble
    c. Battery Charger Alarm

14. Engine sensors for low water temperature near low oil pressure, near high water temperature.

E. In addition to the equipment included in the control panel described above, the unit shall include a power and control junction box mounted on the generator. This junction box shall include:

1. Three phase power conductors terminated with pressure type ring connectors.

2. Neutral connection.

3. Terminal block with marked connection points for all external control connections and for jacket heaters, etc.

4. Molded case line circuit breaker with interrupting rating of 42 KA amperes RMS.

F. Automatic shutdown shall be provided for each of the following conditions:

1. High jacket water temperature

2. Low jacket water pressure

3. Low lubricating oil pressure

4. Engine overspeed

5. Unit fail to start.

G. Auxiliary normal open dry contacts shall be provided for remote transmission of unit failure.

2.08 SUB-BASE:

A. The engine, generator and radiator shall be mounted on a structural steel base designed to maintain proper alignment. Vibration isolators shall be furnished of the size and type recommended by the supplier.

2.09 ENCLOSURE:

A. A sound-attenuated weather-protective housing shall be furnished. The housing shall enclose the complete unit and all related equipment (e.g. battery, battery charger, engine controls and control panel, etc). All components shall be wired and piped within the enclosure.

B. The housing shall be constructed of 14 gauge rolled steel and shall include hinged locking access doors. Housing surfaces shall be prime painted with two coats of a rust resistant primer and finished with a dark green enamel paint.

C. The housing shall be sound insulated, vandal proof, and padlocked. The resulting structure with engine-generator in operation shall not transmit more than 75 db at a distance of 23 feet from the generator in any direction. There shall be no Puretone. The generator set manufacturer shall choose the thickness of insulation to meet the aforementioned sound criteria.

D. The housing shall be furnished with weather-protective fixed louvers, and weather-protective flanged door openings to insure weather-resistant construction.

E. Stainless steel flexible exhaust sections shall be provided. Exhaust outlet shall be terminated with a “shanty cap” designed so to prevent entrance of rain into exhaust outlet. All handles, sheet metal screws, bolts, nuts, hinges, and other exterior hardware shall be stainless steel.

F. Provide factory wired instruction detection style doors switches for each of the enclosure entry doors that shall be wired in series to one another and terminated at a junction box within the generator enclosure.

PART 3 – EXECUTION

3.01 MANUFACTURER'S SERVICES:

A. A minimum of one, eight-hour day shall be provided to supervise the installation and testing of the equipment furnished, to assist in start-up and train Owners maintenance personnel.

B. A minimum of one, four hour day, not including travel time to and from the site, shall be used by a fully qualified field service engineer to make necessary adjustments and to provide operator training on the equipment furnished. This work shall occur after the equipment has been in operation and at the request of the owner, but not to exceed one year after the acceptance of the facility.

3.02 TESTS:

A. At least 48 hours prior to the load test, the manufacturer shall perform a pretest. The pretest shall be conducted in the presence of the Engineer. The pretest shall determine that the unit is ready for load testing and that all components are functioning correctly. All adjustment for tuning the unit shall be made during the pretest. If remedial work is required, the work shall be performed before the load test is conducted.

B. Upon completion of the installation, the manufacturer of the equipment shall test the complete unit, at full load, using load banks, for four continuous hours. During the test, the following data shall be taken at 15 minute intervals:

1. Outside air temperature
2. Generator room temperature
3. Oil pressure
4. Oil temperature
5. Jacket water temperature
6. Battery charge rate
7. Fuel pressure
8. A.C. Volts
9. A.C. Amps
10. Frequency
11. Kilowatts.

C. Following the test, three successive simulated power outages shall be conducted using all connected building load.

D. The equipment shall be left in good operating order and the settings of all alarm and shutdown devices verified.

E. The diesel fuel required for testing shall be supplied by the electrical contractor, upon engineer acceptance of the tests results the electrical contractor shall fill the generator's base tank and make the unit completely ready for full operation.

3.03 OPERATION AND MAINTENANCE MANUALS:

A. Furnish Operation and Maintenance Manuals as specified in Section 01730.

B. Maintenance instructions shall be furnished for batteries, to include simple and clear procedures for addition of liquids, maintaining cleanliness, proper ventilation, proper electrical connections.

C. Maintenance instruction shall be furnished for engines, including recommended lubricants, coolants, etc., recommended maintenance intervals, and recommended ventilation requirements.

D. The Operating manual shall be a simple starting and stopping procedure, with reference to shop drawings information for more complicated procedures.

- END OF SECTION -

SECTION 16720

SECURITY ALARM SYSTEM

PART 1 – GENERAL

1.01 DESCRIPTION:

A. The Work of this Section includes the furnishing and installing of complete a security alarm system as specified in the Contract Documents.

B. The system shall include, but not be limited to, an alarm monitoring control panel, magnetic door switches, timed exit/entry delay control keypad, motion detectors, heat detectors, help call pushbuttons, conduit, fittings and wire.

C. Provide all required coordination with door installations for proper installation of alarm devices and wiring.

1.02 SUBMITTALS:

A. Manufacturer's literature and brochures shall be submitted for all items to be furnished in accordance with the provisions of the SECTION 01300, SUBMITTALS.

B. Submittals required under this section include, but are not limited to the following:

1. Complete system wiring diagrams and elementary or control schematic.

2. Data sheets and outline drawings showing details for mounting all control devices and panel.

3. Battery system load calculations.

4. Standard preprinted sheets or drawings simply marked to indicate applicability to this contract will not be acceptable.

1.03 DELIVERY, STORAGE AND HANDLING

A. Provide in accordance with Section 01600.

B. All materials shall be shipped, stored, handled and installed in such a manner as not to degrade quality, serviceability, or appearance.

1.04 DESIGN CRITERIA:

A. The security alarm system shall be the standard product, as modified by these Specifications of the manufacturer stated for this type equipment. In addition, the manufacturer shall maintain a permanent service organization and a supply of spare parts

as necessary to provide adequate service to this system within 24 hours from receipt of a request for service.

B. The system shall be UL approved for commercial burglary alarm system type DSC by Johnson Controls, not equal as the city's has standardized this system in their other pump stations.

C. The system design and installation shall conform to the following standards:

1. All equipment shall be UL listed for its intended purpose.

2. NFPA standards 70, 72, 90A, 92A, and 101.

3. Current State Building Code.

4. The Americans with Disabilities Act (ADA).

5. All requirements of all local authorities having jurisdiction.

D. System Provider Qualifications:

1. Minimum 20 years experience in the manufacturing, integration and testing of security alarm systems.

2. An experienced security alarm system equipment supplier who has completed systems integration work for installations similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.

1.05 SYSTEM OPERATION:

A. The system shall be have the following alarm zones.

1. Pump Station Fire (Heat Detectors)

2. Pump Station Intrusion

3. Generator Enclosure Intrusion

4. Help Call

5. Spare

6. Spare

7. Spare

8. Spare

B. Actuation of the door switch or motion sensor when the system is armed shall:

1. Actuate discrete remote dry contact alarm for the associated zone to SCADA system.

2. Actuate the respective zone alarm lamp at the system alarm key pad.

3. Visually indicate the alarm initiating zone via the LCD display on the system alarm keypad.

C. Actuation of the Help Call Pushbutton shall:

1. Actuate discrete remote dry contact alarm for the associated zone to SCADA system.

2. Actuate the respective zone alarm lamp at the system alarm key pad.

3. Visually indicate the alarm initiating zone via the LCD display on the system alarm keypad.

D. The system alarm key pad panel shall allow a timed exit/entry control to access the building without tripping the intrusion alarm. Authorized personnel entering the building will have up to five minutes to de-activate the alarm system prior to sending an alarm output.

E. Opens, ground, or tampering, occurring on the zone monitor circuit shall cause a trouble signal and actuate a discrete remote dry contact alarm for the associated zone to SCADA system. To clear a trouble signal transmission, the trouble must be corrected and the system will automatically return to its normal state of operation. To restore the device actuating the alarm, the alarm must be secured to its normal position and the system reset switch operated. A trouble signal on an individual zone monitor circuit shall not interfere with the automatic transmission of an alarm signal on another zone monitor circuit occurring during the same period.

PART 2 – PRODUCTS

2.01 SYSTEM CONFIGURATION:

A. Provide a complete security system consisting of the following major subsystems:

1. Detection subsystem: Subsystem shall consist of sensors to detect alarm and trouble conditions.

2. System Alarm Key Pad: Subsystem shall consist a speaker, annunciation lights, function keys, and LCD annunciation display to properly display and control all system functions and alarms.

3. Communications subsystem: Subsystem shall consist of elements required to ensure that pertinent data is transferred from the point of origin to the point where appropriate actions can be taken.

4. Assessment subsystem: Subsystem shall consist of electronic devices required to visually and audibly verify the validity of security system alarms.

5. Alarm reporting subsystem: Subsystem shall consist of electronic devices to control, process, integrate, and annunciate security system data.

6. Power subsystem: Subsystem shall consist of components required to ensure continuous operation of the entire security system.

B. All system functions, alarms and annunciations shall be monitored and controlled at the system alarm key pad.

C. The system shall have the capacity to collect date/time entry data in non-volatile memory and display the date/time entry when requested by an authorized user.

D. The system shall have the capacity to collect, communicate, and display a minimum of 8 programmable sensor zone alarms and to enable control of one or more response devices in each of the sensor zones.

E. A single alarm shall be annunciated at system alarm key panel within approximately 2 seconds after sensor transducer or other detection device activation.

F. Provide the capability to detect when a critical component of the system experiences temporary or permanent loss of power and to declare an alarm at the system alarm keypad.

G. Alarms shall not be generated by power switching; however, an indication of power switching and on-line source shall be provided at the system alarm keypad. Upon restoration of normal power, the system shall automatically switch back to the primary source. Low voltage condition of an on-line battery and battery charger circuit failure shall be detected and reported as a trouble condition.

2.02 SYSTEM CONTROL PANEL:

A. Provide micro-processor based modular components to make up a complete control system. The panel shall have the following features:

1. Alarm output relays.

2. Zone modules, number as required for proper functionality for each system, access lamps, secure lamps, access/secure key switches for each.

3. Earth detection module.

4. Sealed lead acid battery standby power shall be supplied. It shall be under lock and key within this supervised cabinet to prevent deliberate tampering.

5. Solid state battery charger.

6. Alarm resound module.

7. Total system supervision by a micro-processor which will supervise all wiring regardless whether or not the area of protection is bypassed or not.

8. Quantity five normally open dry contacts which close on alarm conditions.

9. Surge protector.

B. Electrical power shall be obtained by the normal electrical distribution system. Power shall be continuously monitored and, if interrupted, automatic switching from primary to emergency backup source shall be accomplished without interruption or degradation of critical system function.

C. Furnish 120 volt AC service, transformed through a two-winding isolation transformer and rectified to low-voltage DC for system operation. Obtain primary power at the 120V breaker as indicated in the Contract Documents.

D. Provide lockable device at circuit breaker and label the circuit breaker in that panelboard: "Alarm System Do Not Turn Off."

E. Provide backup power to the primary power by dedicated batteries in the Control Panel. Batteries shall be capable of operation in any position and shall be protected against venting caustic chemicals or fumes within an equipment cabinet. Batteries shall also be capable of continuous operation for up to 4 hours without recharge or replacement. If the sensors power requirements exceed the allowable UL rated capacity of the control communicator battery, provide the number of separate power supplies required to power the sensors. Provide each power supply with its own rechargeable battery and charger.

F. Provide system components to facilitate modular subassembly and part replacement. Electronic components of the system shall be of the solid-state type, mounted on printed circuit boards conforming to UL 796. Circuitry shall not be so densely placed as to impede maintenance. Power-dissipating components shall incorporate safety margins of not less than 25 percent with respect to dissipation ratings, maximum voltages, and current-carrying capacity. Light duty relays and similar switching devices shall be solid-state or hermetically sealed electromechanical type.

G. Provide only components in current manufacturing production. Components shall be manufactured to meet requirements specified herein and shall be free from characteristics and defects which affect appearance or serviceability or which render equipment unsuitable for the intended purpose. Provide components designed for continuous operation at specified conditions.

H. Alarm detection, communication, and power circuits shall be protected against lightning and voltage transients. Surge suppression device shall conform to UL 1449, rated single pulse transient energy by metal oxide varistor (MOV). The protective device shall be automatic and resettable and shall be active at all times. Fuses shall not be permitted as protection devices.

I. Provide control devices to ensure ease of operation of specified characteristics. Where applicable, clockwise rotation of controls shall result in an increasing function. Controls, switches, visual signals, and indicating devices, input and output connectors, terminals, and test points shall be clearly marked or labeled on hardware to permit quick identification, intended use, and location. Terminal markings and labels shall be of a permanent and legible type and located to be visible when the associated system wiring is in place. Identification markings shall be associated with each adjustment device or item requiring periodic maintenance. Safety warning or cautions shall be marked in conspicuous red letters. Controls not required for operation of the system shall be inaccessible to the system operator.

J. Cabinets, control communicators, wiring gutters, and other component housings, collectively referred to as enclosures, shall be formed and assembled to be sturdy and rigid. Metal thickness shall not be less than those in Tables 8.1, 8.2, and 8.3 of UL 1610 for alarm components, and NEMA ICS 2 and NEMA ICS 6 for other enclosures.

K. Doors and covers shall be flanged. Where doors are mounted on hinges with exposed pins, hinges shall be of the tight-pin type, or ends of hinge pins shall be tack welded to prevent ready removal. Provide doors having a latch edge length of less than 24 inches with a single lock. Covers of junction boxes provided to facilitate initial installation of the system shall be held in place by tack welding, brazing, or one-way screws.

L. Ventilation openings in enclosures and cabinets shall conform to the requirements of UL 1610. Sheet metal enclosures shall be designed for surface or recessed wall mounting with top hole slotted.

M. Locks and key-lock-operated switches required to be installed on component enclosures shall be UL listed, round-key type with three dual, one mushroom, and three plain pin tumblers, or shall have a pick resistance equal to a lock having a combination of five cylinder pin and five-point three-position side bar in the same lock. Keys shall be stamped "DO NOT DUP". Key-lock-operated switches shall be keyed differently.

2.03 SYSTEM ALARM KEY PAD:

A. Provide control devices to ensure ease of operation of specified characteristics. Where applicable, clockwise rotation of controls shall result in an increasing function. Controls, switches, visual signals, and indicating devices shall be clearly marked or labeled on hardware to permit quick identification, intended use, and location.

B. Entry/Exit delay. Timer shall be adjustable from 0 to 5 minutes.

C. Annunciators shall be liquid crystal displays (LCDs). Annunciators shall be so connected in the circuit that failure of the annunciator, socket, or protective circuitry shall not result in an improper or indeterminate signal. LCDs shall be compatible with standby power supplies.

D. Common trouble signal, trouble silencing switch, power on lamp, reset switch, alarm acknowledge switch and common zone test.

E. An alarm shall be annunciated to clearly identify any component experiencing power loss.

2.04 MAGNETIC DOOR SWITCHES:

A. Provide dual contact recessed mounted magnetic door switches consisting of a contact housing element and magnet housing elements.

B. The switch mechanism shall have a gap distance range up to 3/8-inch.

C. The contact element shall contain a hermetically sealed magnetic reed switch and shall be potted in the contact housing with a polyurethane base compound.

D. The magnetic element shall contain a rare earth magnet made of neodymium iron borton.

E. The recessed mount housing for the switch elements shall have rugged uni-body construction made of flame retardant ABS plastic that that allows the housing to be snapped locked in a ¾” to 1” hole.

F. The contact element shall have 12” cord lead and shall terminate in a junction box or other electrical enclosure.

G. Conductors running from the door switch shall be installed within a flexible armored raceway constructed from corrosion-resistant metal. The end of the armored raceway shall terminate in a junction box. Armored raceway ends shall be mechanically secured to junction boxes by clamps or bushings.

2.05 MOTION DETECTORS

A. Provide dual technology wall mounted motion detector sensors combining passive infrared and microwave sensors designed and manufactured specifically to be mounted in a single enclosure.

B. Passive infrared (PIR) sensor section: Sensor shall detect intruder presence by monitoring the level of infrared energy emitted by objects within a protected zone. Sensor shall initiate an alarm upon observing increased or fluctuating infrared energy caused by the

presence and motion of an intruder whose temperature is as little as 3 degrees F different from the background temperature. Sensor shall be passive in nature; no transmitting energy shall be required for detection. Sensor shall be sensitive to infrared energy emitted at wavelengths corresponding to the human body or other objects at ambient temperatures. Sensor detection pattern shall be approximately 40’ x 55’ Sensor shall have RFI and white light immunity.

C. Microwave sensor section: Sensor shall detect intruder presence by transmitting electromagnetic energy into a protected zone, receiving direct and reflected energy, and monitoring frequency shift between transmitted and received signals. If more than one device is used in an area, devices shall operate on different frequencies. Provide for selective filtering by sensor to minimize nuisance alarms due to moving metal objects such as fan blades and interference from radar, or other sources of electronic interference. Transceivers shall consist of a combined transmit/receive antenna and an adjustable-gain preamplifier in a single housing. Provide transceivers with sensitivity adjustments. Transceiver controls shall permit adjustment of transmission range and alarm signal threshold. Sensitivity controls shall be inaccessible to operating personnel. Sensitivity requirements shall be met with sensitivity controls set approximately at midrange.

D. The enclosure containing two sensor sections shall be tamper alarmed.

E. Both microwave and PIR sections shall activate simultaneously to generate an alarm. Only an intrusion characterized by volumetric motion and radiant body heat shall be detected. Sensor shall provide some means of indicating an alarm condition during installation and calibration. A means of disabling the indicator shall be provided within the sensor enclosure.

2.05 HEAT DETECTORS

A. Fixed temperature 135 degrees F, rate of rise, vapor-tight industrial grade units.

2.06 HELP CALL PUSHBUTTONS

A. The pushbuttons shall be red, twist to release keyed pushbutton with a minimum (1) NO and (1) NC contact and mounted on a curved stainless steel plate factory engraved with “Help Call”. The pushbutton shall surface mounted on a standard device box.

B. Provide clear polycarbonate resin thermal covers over all Help Call pushbutton stations.

PART 3 – EXECUTION

3.01 INSTALLATION:

A. No wire smaller than No. 14 AWG shall be installed. All wiring shall be color coded.

B. Coordinate the installation of the door switches and wiring with the existing doors.

C. Ground system components and conductor and cable shields to eliminate shock hazard and to minimize ground loops, common-mode returns, noise pickup, cross talk, and other impairments.

3.02 FINAL TESTS / WARRANTY

A. The system shall be fully tested by a UL certified testing company, in accordance with UL guidelines and NFPA standards. Each and every device shall be tested.

B. A copy of the final test report shall be submitted indicating proper functioning of the system and conformance to the specifications. The test shall be performed by UL certified and factory-trained qualified technicians. Each and every device shall be tested, and standalone operation of remote panels shall be verified. Final testing [and UL certification] shall be performed by the same company that will hold and execute the Test and Inspection contract.

C. The manufacturer shall guarantee all system equipment for a period of three (3) years from the date of final acceptance.

D. The contractor shall guarantee all raceways and wiring to be free from inherent mechanical or electrical defects for one (1) year from the date of final acceptance of the system.

3.03 ADJUSTING:

A. Occupancy Adjustment. When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting and reprogramming to suit actual occupied conditions. Provide up to two visits for this purpose without additional cost.

3.04 DEMONSTRATION:

A. Engage a factory-authorized service representative to explain programming and operation of system and to train Owner's maintenance personnel on procedures and schedules for maintaining, programming, operating, adjusting, troubleshooting, and servicing system. Provide a minimum of four hours' training in operation and maintenance.

3.05 TRAINING

A. The contractor shall provide the services of the manufacturer's representative for a period of 4 hours, during normal business hours, to instruct the owner's designated personnel on the operation of the system.

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SECTION 16740
COMMUNICATION SYSTEM

PART 1 – GENERAL

1.01 SCOPE

A. The Work of this Section includes the furnishing and installing of complete communication system as specified in the Contract Documents.

B. The system shall include, but not be limited to plywood backboards, conduit, CAT 6 cable, fiber optic cable, back boxes, jacks, wall plates, fittings, terminations, equipment rack, patch panels, punch down panels, Ethernet switches, power supplies, and all other appurtenances leaving the entire installation complete.

C. Install a complete raceway conduit system including mounting back boxes and junction boxes from each outlet, CCTV camera, and control panel to the equipment rack location. Install one CAT 6 cable for each tel/data jack module and CCTV Camera from device back to equipment rack in tel/data room.

D. Terminate all CAT6 cable at patch panel (Data, Camera, and control panels) and punch down panels (Telephone) mounted in equipment rack.

E. Provide all required coordination with telephone utility provider and owner.

1.02 MEASUREMENT AND PAYMENT

A. Measurement and payment for the Work described in this section will be made in accordance with the provisions of SECTION 01025, MEASUREMENT AND PAYMENT.

1.03 SUBMITTALS

A. Manufacturer's literature and brochures shall be submitted for all items to be furnished in accordance with the provisions of the SECTION 00700, GENERAL CONDITIONS.

B. Submittals required under this section include, but are not limited to the following:

1. CAT 6 Cable and Jacks

2. Fiber Optic Cable

3. Equipment Rack

4. Patch Panels

5. Punch Down Panel

6. Patch Cords

1.05 PRODUCT HANDLING

A. All materials shall be shipped, stored, handled and installed in such a manner as not to degrade quality, serviceability, or appearance.

PART 2 – PRODUCTS

2.01 CONDUIT AND BACK BOXES

A. Conduit and back boxes shall be as specified under SECTION 16130, RACEWAYS AND FITTINGS.

2.02 CAT 6 CABLE AND JACKS

A. Cable shall be CAT 6 type having four each individually twisted pair, 22 AWG conductors with a blue PVC jacket.

B. Jacks and Jack Assemblies shall be Modular, color-coded, eight-position modular receptacle units with integral IDC-type terminals. Provide device wall plates for each jack, wall plates shall be as specified under SECTION 16500, LIGHTING SYSTEMS.

2.03 FIBER OPTIC RISER CABLE

A. Single Mode OS2 Type - Outdoor Stranded Loose Tube, Gel Free, 12-Strand, all Dielectric with HDPE jacket.

B. Provide termination connectors on all strands on both ends.

2.04 EQUIPMENT RACK

A. Provide a Steel equipment rack enclosure with uniform, baked-enamel factory finish over rust-inhibiting primer.

B. Rack shall be wall Mounted, 24 inches high, 22” inches wide (19” wide equipment mounting), 18 inches deep with rear hinged swing section and plexiglas front door.

C Rack to have universal hole pattern on front and rear flanges, and mounting 10-32 threaded mounting holes on both sides of rack assembly

D. Rack to have grounding bus bar and is to be grounded building grounding system.

E. Rack to have top mounted plug in type ventilation fan.

F. Provide with full vertical mounted power distribution strip consisting of grounded receptacles a master power on/off switch, pilot light and surge protection.

2.04 PATCH PANEL

A. Provide a 19” wide rack mounted high density patch panel with a minimum 48 port with integral cable management panel located below the patch panel.

B. Wiring shall conform with T568B wiring.

2.05 PATCH PANEL – FIBER OPTIC CABLE

A. Provide 19” wide rack mounted light guide interface unit (LIU) patch panels with a minimum 12 ports, and SC connectors.

2.06 PUNCH DOWN PANEL

A. Provide a 19” wide 110 rack mounted punch down panel with minimum 50 pair blocks and integral cable management panel located below the punch down panel.

2.07 PATCH CORDS

A. Provide CAT 6, 3’ long patch cords ETL verified to TIA-568-B for installation for connections between the patch panels and Ethernet switch.

B. Provide fiber optic patch cords for installation for connections between the fiber optic patch panel and Ethernet switch.

2.08 POE ETHERNET SWITCHES

A. Provide a PoE Ethernet switch and mount in the equipment rack.

B. The Ethernet switch shall have 24 auto sensing 10/100/1000BASE-T PoE ports and two GbE fiber ports. All ports shall support auto negotiation or manual configuration for 10/100/1000 MHz or full/half duplex.

C. The Ethernet switch shall be IEEE 802.1 and IEEE 802.3 compliant. The switch shall support 10/100/1000BASE-T and 1000BASE-SX standards. The switch shall support IEEE 802.3x flow control. Port setting controls shall include enable/disable and speed selection. The switch shall use store-and-forward switching mode.

D. The Ethernet switch shall have an LED power indicator and shall operate from a 120VAC power source. The switch MSR LED, PoE LED, and port link status LED The switches shall be suitable for operating from -25°C to 65°C fan less and from 5 percent to 95 percent non-condensing relative humidity. The switch shall be UL approved.

E. Ports to support both 15.4 W and 30W high power with a minimum total PoE power budget of 150W.

F. The Ethernet switch shall support a tree or ring network topology. The switch shall support SNMPv3 and IP addressing via BootP/DHCP. The port configurations shall be accessible through a standard Web browser.

H. The Ethernet switch security features shall include capability to disable ports and password security for configuration. The switch shall support multicast messaging via IGMP protocol and shall utilize IGMP snooping. The switch shall support port based virtual LAN (VLAN) configuration. The switch shall support the IEEE 802.1p standard for QoS traffic prioritization. The switch shall come supplied with configuration and management software for installation on a Windows-based PC. The switch shall come supplied with all necessary cables to connect the switch to a Windows-based PC for configuration.

I. Ethernet Switch shall be manufactured by Cisco, Juniper or Hewlett Packard.

2.09 UNINTERRUPTABLE POWER SUPPLIES (UPS)

A. For each equipment rack provide a 2200VA 19" wide rack mounted UPS with LCD display and LED status indicators for battery status.

B. Input Power: 120VAC, single phase via 8 foot cord with a NEMA 5-20P plug.

C. Output Power: 120VAC, single phase via (6) NEMA 5-15R and (2) NEMA 5-20R rear mounted receptacles.

D. Interface ports: Serial (RJ45), USB, and SmartSlot.

E. Surge Energy Rating: 480J.

F. Filtering: Full-time multi-pole noise filtering with 0.3% IEEE surge let-through, zero clamping response time and meets UL 1449.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Coordinate location of rack mounted equipment with owner prior to making any terminations.

B. Coordinate type of jack module in each tele/data wall plate with owner prior to making any terminations.

C. Fire stop and seal all penetrations as required to maintain fire separations.

D. Cables shall be terminated with connecting hardware of same category or higher that shall comply with TIA/EIA-568-B.2, IDC type, with modules designed for punch-down caps or tools

E. All cables and wall jacks shall be labeled, comply with TIA/EIA-606-A and UL 969 for labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

3.02 TESTING

A. All cables shall be tested for continuity by contractor per manufacturer's specifications.

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DIVISION 17

SECTION 17300

INSTRUMENTATION AND CONTROLS

PART 1 – GENERAL

1.01 DESCRIPTION

A. The work of this section includes furnishing all labor, materials, tools and equipment required to furnish and install a complete pump station RTU control panel, and instrumentation and implement into the existing town wide SCADA system. The system shall include instrumentation equipment, a new remote telemetry unit panel (RTU-1) and modification to the existing SCADA system located at located at the Framingham Department of Public Works.

B. The work required by this section shall include all primary instrumentation equipment and devices necessary to provide process data and monitoring as shown and as specified. The particular requirements of this section are specific in that this system supplier must furnish and install a system which will provide for an input/output SCADA interface. All input/outputs (I/O) shall be collected as noted in the I/O lists of this project. In addition, the system shall include a Modbus communication interface and connections to additional equipment being provided under other Divisions of these specifications. The loop descriptions provide a functional description for the process portion of the system.

C. The system supplier shall carefully review all requirements of this section in order to fully understand the limit of responsibility and the extent of what must be done to complete this portion of the system. It shall be understood that this system supplier will provide for a complete and operational I/O system that shall be completely documented and coordinated in order to provide for a complete system interface. Data collection shall be accomplished through a data highway via PLC to PLC network, remote I/O or hard-wired inputs to the main PLC. All input/outputs (I/O) shall terminate at each of the respective panels.

D. The capacity and quality of instruments and equipment shall be provided such that they perform the function described in the SYSTEM DESCRIPTION, as shown on the Contract Drawings and as listed in the Instrumentation List at the end of this section. It is the intent of this section of the specifications to specify a complete instrumentation and monitoring system. Anything that is not shown on the drawings but is mentioned anywhere in the specifications or vice versa, or anything not expressly set forth in either but which is reasonably implied, shall be furnished and performed as though specified, shown and mentioned in both. If an item appears in one area of the contract documents but not in another, it shall be provided in its entirety. This system supplier shall obtain and review complete set of the specifications and drawings prior to submitting final costs for the work of this section and/or any related sections.

E. Equipment under this section shall be fabricated, assembled, installed, and placed in proper operating condition in full compliance with details, drawings, specifications, engineering data, instructions and recommendations of the equipment manufacturer as approved by the Engineer.

F. The Instrumentation System supplier under this Section shall insure total compatibility where interfacing between equipment is required and shall initiate and maintain close communication and cooperation with the supplier of the equipment throughout the shop drawing and equipment start-up and testing phases of the work and insure total compatibility of all required interfacing at no extra cost to the Owner.

G. An Ethernet based fiber optic network and a backup radio telemetry network shall be configured for this instrumentation system in order to link input/output data to the existing SCADA system. A PLC to PLC network shall be established. All SCADA HMI and OIT screen configurations shall be the responsibility of the owner and not this Instrumentation System Supplier.

H. Due to the complexity of the work of this and other related sections and in order to establish a basis of bid for the equipment designed herein, a specific PLC manufacturer and control panel equipment has been indicated within on the Instrumentation and Controls Drawings. This has been done to match existing equipment at the SCADA system and other pump stations. In order to properly establish the requirements of this and other related sections, all system equipment and components for this PLC (Programmable Logic Controller) system as designed shall be as manufactured by Allen Bradley. Any deviation or substitutions at this time which requires any direct additional costs or additional work and results in additional costs for the requirements of this section shall be incurred by this Contractor and not the Owner. Also, any cabling data exchange changes, equipment changes, etc. shall be the responsibility of this system supplier to coordinate and provide as necessary to allow acceptability of the approved system. This shall be completely understood and there shall be no additional costs incurred due to failure to provide these requirements as noted.

I. Provide and configure a new fiber optic network and radio modem network telemetry control panel that shall include, but not be limited to, PLC, instrumentation, UPS system, power distribution equipment, power supplies, Ethernet Switch, radio modems, antennas, and CAT6 interface cable. The new fiber optic network telemetry control panel shall be implemented into an existing city wide fiber optic network SCADA system.

J. Work specifically required under this Section and Section 17320 includes all Instrumentation/Controls work shown on or required by Contract Drawings IC-1 thru IC-3, I-001, and I-101 thru I-110.

L. The contractor undertaking the work of this section shall review the other specification sections for additional scope items that are included in or bear upon the work.

1.02 SUBMITTALS

A. Submit the following in accordance with Section 01300 - Submittals:

1. Manufacturer's data, order sheet or equivalent for each individual instrument or device being supplied. The information shall include but not be limited to model number, exact chart, scale or calibration range, type of enclosure and mounting, input/output and power data and the instrument tag number (or loop number for auxiliary equipment). Sales literature will not be accepted.

2. Manufacturer's outline and mounting dimensions for all field mounted devices, and scaled layout drawings for primary and supplemental control panels, including interfacing details for equipment to be supplied under DIVISION 11.

3. A letter stating the control panel shall be fabricated per drawings I-001, and I-101 thru I-107 and specification 170xxx.

4. The system supplier shall clearly identify any exception to the specification or drawings. Failure to do this will be grounds for rejection of the submittal.

B. For approval before release for manufacturing:

1. All equipment to be furnished under this Section must be approved prior to any of this equipment being released for manufacturing unless otherwise noted by the Engineer.

C. Shop drawings shall be submitted in accordance with Section 01300 - Submittals and include the following special conditions:

1. All material submitted for review shall be contained in one submission. The material shall be furnished in bound volumes as required for a complete submittal. Loose material submitted will not be reviewed. Partial submittals unless agreed to by the Engineer will not be reviewed. Sales bulletins or other general publications are not acceptable as submittals.

2. If more than two submittals (initial submittal and one re-submittal) are required for approval, the system supplier shall be liable for back charges for the Engineer's services to review additional submittals.

D. Shop drawing review period for this section shall extend beyond the specified period as defined in Section 01300 - Submittals. Due to the complexity of the system the review period allowed shall be a minimum of forty-five (45) days unless otherwise agreed to by the Engineer.

E. Operation and Maintenance Manuals shall be submitted in accordance with the requirements of Section 01730 - Submittals.

1.03 RESPONSIBILITY FOR EQUIPMENT

A. The Contractor shall be responsible for providing and placing in satisfactory operation all instruments and equipment necessary for a complete system. This shall include all piping, electrical connections, and system engineering as provided by a qualified Instrumentation and Control System Supplier, and accessories required by the Work of this Section or other related Work included under other Sections in the Contract Documents.

B. The supply of the RTU control panel, instrumentation shall be by a single Instrumentation and Control System Supplier. The supplier shall be responsible to the Contractor for: (1) satisfactory detailed design of a complete and coordinated system (2),

start-up and testing services, (3) training, and (4) services to assure satisfactory operation.

C. The Contractor shall not purchase separate equipment and attempt to assemble a system. This Work is to be performed by a qualified Instrumentation and Control System Supplier as approved by the Engineer.

D. The Contractor shall furnish record drawings for each entire system. This shall include drawings for all locations with point to point wiring for the equipment. The drawings shall be complete and shall require on site verification and acceptance by the Engineer.

E. The Instrumentation and Control System Supplier shall be required to furnish equipment that is installed under other Sections in the Contract Documents. The Contractor shall be responsible for coordinating this Section with the necessary equipment in order to provide for a complete installation. It shall be coordinated such that there is proper installation of this equipment between suppliers in order to avoid delays in completion due to availability of this equipment. The Instrumentation and Control System Supplier shall provide a separate submittal on this specific equipment for early approval in order to avoid delays.

1.04 DESIGN CRITERIA

A. All instrumentation shall meet or exceed I.S.A. Standards and Recommended Practices, ANSI, National Electrical Code, OSHA, and any other applicable code or local regulation. All panel instruments shall be of the same manufacturer and model type to provide uniform appearance.

1.05 SYSTEM DESCRIPTION

A. Each loop description contains the basic functional description of the process. All components necessary to complete these functions shall be provided to satisfy the requirements of this section.

B. Contacts referred to in the Loop Descriptions shall be "dry" type either normally open or normally closed as required for the function described. All contacts shall be rated 10 ampere at 120 volts.

C. The scales of instruments and devices described in the instrument loop descriptions shall be as specified and noted in the Instrument List. All indicator scales shall read out in appropriate "Engineering" units. In cases where this information is not provided this shall be clarified and coordinated with the Engineer.

D. Loop descriptions (and associated Loop Drawings) are intended to provide a conceptual overview of required system operation. Each of the loops may or may not show all specific components necessary for each system operation. The instrumentation system supplier shall provide all necessary equipment, devices, components, signal conditioners, PLC components and other requirements for complete and satisfactory system operation. The system supplier shall provide all necessary current-to-current converters (I/I's) required by loop description to provide proper signal loading.

E. All signal interfacing compatibility is the responsibility of the supplier of equipment under Section 17300 (Instrumentation and Control System) and requires close coordination and cooperation with the supplier of equipment under DIVISION 11 - EQUIPMENT. In the loop description, any equipment or device which is not noted but shown elsewhere on loop drawings, specifications, etc. shall be provided by this system supplier in its entirety. Anything that is not shown on the drawings but is mentioned anywhere in the specifications or vice versa, or anything not expressly set forth in either but which is reasonably implied, shall be furnished and performed as though specified, shown and mentioned in both. If an item appears in one area of the contract documents but not in another, it shall be provided in its entirety. This system supplier shall obtain and review complete copies of both the specifications and drawings prior to submitting final costs for the work of this section and/or any related sections. Any discrepancies shall be brought to the attention of the Engineer prior to submission of the final bid price in order to clarify any and all issues.

1.05 INSTRUMENTATION AND CONTROL SYSTEM SUPPLIER

A. The Instrumentation and Control System Supplier shall be one of the following pre-qualified Instrumentation and Control System Supplier's listed in alphabetical order.

1. Electrical Installations, Inc.
Moultonboro, New Hampshire
603-253-4525

2. Elm Electrical
Marlborough, Massachusetts
508- 480-9300

3. Harbor Controls
North Kingstown, RI
401-667-0930

4. R. E. Erickson Co., Inc.
Walpole, Massachusetts
508-668-9330

B. Only pre-qualified Instrumentation and Control System Suppliers shall be allowed.

1.06 LOOP DESCRIPTIONS

A. LOOP 100: STATION SUCTION PRESSURE MONITORING

1. The Station suction water pressure on the incoming water line shall be measured by a pressure indicating transmitter (PIT-100) and shall be connected to the RTU PLC via hardwired I/O. The water pressure shall be indicated at the OIT and SCADA HMI.

2. The water pressure shall be trended and recorded (PIR-100) at the SCADA HMI.

3. Low and High pressure alarms (PAL-100 & PAH-100) shall be based on an OIT and SCADA HMI entered pressure alarm setpoints.

B. LOOP 101: WATER BOOSTER PUMP #1

1. Water Booster Pump #1 is controlled via a floor mounted VFD. Operation of Water Booster Pump #1 shall be monitored and controlled automatically through the RTU PLC via hardwired I/O. The Pump has a Hand/Off/Auto selector switch mounted on the VFD cabinet door, when in the "Auto" position the remote automatic control and remote manual control through the OIT and SCADA HMI is enabled.

2. The following signals shall be wired to the RTU PLC I/O and displayed at the OIT SCADA HMI.

   a. Water Pump #1 H/O/A selector switch in "Auto" (YI-101A)

   b. Water Pump #1 Run status (YI-101B)

   c. Water Pump #1 Start/stop pump (YS-101)

   d. Water Pump #1 speed feedback (SI-101)

   e. Water Pump #1 speed control (SC-101)

   f. Water Pump #1 Overtemp (TAH-101)

   h. Water Pump #1 Pump VFD Alarm (YA-101)

3. Non-resettable elapsed time meter shall be displayed at the OIT and SCADA HMI (KQI-101).

4. A motor state disagreement alarm shall be displayed at the OIT and SCADA HMI if the called state of the motor and the state of the run status contact do not agree after a preset adjustable time (YA-101B). The disagreement alarm is enabled if the H/O/A switch is in the "Auto" position. The disagreement alarm must be manually reset through the OIT or SCADA HMI before Remote Control is enabled.

5. Remote Automatic Tank Level Control: The pumps shall be arranged in an operator selectable lead/lag/standby manner. The lead pump is automatically started (YS-101) when the tank storage level (LT-104) drops below an operator configured low level setpoint. The VFD speed command (SC-101) is automatically controlled to maintain the station flow (FIT-111) to an operator configured flow setpoint. The pump will continue run until the water storage tank level (LT-104) reaches an operator configured high level setpoint.

6. If the lead pump VFD speed command exceeds 90% for more than 2 minutes in order to maintain pressure the lag pump shall start and both speed lead and lag

shall be reset to 50% speed and the automatic pressure control shall resume controlling both pumps to the same speed. If the lead and lag pumps are running and their VFD speed command drops bottoms out at the low speed command limit for more than 2 minutes the lag pump shall stop and the automatic pressure control shall resume controlling only the lead pump. The standby pump shall remain in standby until the operator manually changes the status to either lead or lag.

7. Remote Manual Control: The pump(s) is manually start/stopped (YS-101) and VFD speed command (SC-101) is manually entered via the OIT and SCADA HMI.

8. The pump shall automatically shutdown upon a low pressure alarm (PAL-100) in the pump suction line or a high pressure alarm (PAH-110) in the pump discharge line.

C. LOOP 102: WATER BOOSTER PUMP #2

1. Same as described in LOOP 101.

D. LOOP 103: WATER BOOSTER PUMP #3

1. Same as described in LOOP 101.

E. LOOP 104: WATER STORAGE TANK LEVEL

1. A remote water storage tank level is being measured by an existing level transmitter (LT-104) and is connected to an existing SCADA system PLC and available over the SCADA communications network. The level shall be indicated at the OIT and SCADA HMI.

   a. The tank level shall be trended and recorded (LIR-104) at the SCADA HMI.

   b. Low and High level alarms (LAL-104 & LAH-104) shall be based on an OIT and SCADA HMI entered level alarm setpoints.

   c. The tank level (LT-104) shall be transmitted via an analog output to chart recorder (UIR-105).

F. LOOP 110: STATION DISCHARGE PRESSURE MONITORING

1. The Station discharge water pressure on the outgoing water line shall be measured by a pressure indicating transmitter (PIT-100) and shall be connected to the RTU PLC via hardwired I/O. The water pressure shall be indicated at the OIT and SCADA HMI.

2. The water pressure shall be trended and recorded (PIR-110) at the SCADA HMI.

3. Low and High pressure alarms (PAL-110 & PAH-110) shall be based on an OIT and SCADA HMI entered pressure alarm setpoints.

G. LOOP 111: STATION DISCHARGE FLOW MONITORING

1. The station discharge flow rate shall be measured by a pressure differential flow indicating transmitter (FIT-111) and shall be connected to the RTU PLC via hardwired I/O. The flow rate shall be indicated at the OIT and SCADA HMI.

2. The flow rate shall be trended and recorded (FIR-111) at the SCADA HMI.

3. The following flows totals shall be calculated and displayed at the OIT and SCADA HMI:

a. Non-resettable running flow total (FQI-111-1)

b. Previous day total (FQI-111-2)

b. Current day flow total, automatically reset at midnight (FQI-111-3)

c. Resettable flow total (FQI-111-4)

H. LOOP 115: PRESSURE RELIEF VALVE MONITORING

1. The pressure relief valve shall have an open position proximity switch (ZSO-115) and shall be hardwired into the RTU PLC. When activated the alarm shall be annunciated at the OIT and the SCADA HMI:

I. LOOP 120: GENERATOR MONITORING

1. The following status and alarms shall be hardwired into the RTU PLC and displayed/annunciated at the OIT and the SCADA HMI:

a. Generator on (YI-120A)

b. Generator not in auto (YI-120B)

c. Generator failure (YA-120A)

c. Generator alarm (YA-120B)

d. Generator Low Fuel Tank Level (YA-120C)

e. Generator Fuel Tank Leak (YA-120D)

2. The following data shall be polled by the RTU PLC via Modbus TCP from the generator control panel and displayed at the OIT and the SCADA HMI:

a. Jacket water temperature

b. Lube oil temperature

c. Lube oil pressure

d. Battery voltage

e. RPM

f. A.C. Volts per phase

g. A.C. Amps per phase

h. Frequency

i. Elapsed time meter

J. LOOP 121: TRANSFER SWITCH MONITORING

1. The following status and alarms shall be hardwired into the RTU PLC and displayed/annunciated at the OIT and the SCADA HMI:

a. Transfer switch in normal position (YI-121A)

b. Transfer switch in emergency position (YI-121B)

c. Loss of utility (normal) power (YI-121C)

I. LOOP 122: UTILITY POWER MONITORING

2. The following data shall be polled by the RTU PLC via Modbus TCP from the main switchboards digital power meter and displayed at the OIT and the SCADA HMI:

a. A.C. Volts per phase

b. A.C. Amps per phase

c. Frequency

d. Harmonic Distortion

e. Watts

f. Volt Amperes

g. Power Factor

h. Demand Watts

i. Demand Volt Ampere and

j. Watt Hours

K. LOOP 125: RTU-1 PANEL POWER FAILURE

1. Loss of 120 VAC power to the new RTU control panel (JAL-125) shall be annunciated at the SCADA HMI.

L. LOOP 126: RTU-1 24VDC POWER SUPPLY FAILURE:

1. A 24 VDC power supply failure in the new RTU control panel (JAL-126) shall be annunciated at the OIT and SCADA HMI.

M. LOOP 127: RTU-1 UPS MONITORING:

1. The following UPS system status and alarms shall be hardwired into the RTU PLC and displayed/annunciated at the OIT and the SCADA HMI:

a. UPS ready (JI-127)

b. Replace batteries (JAL-127A)

c. Buffering (JAL-127B)

N. LOOP 128: 120V MAIN SURGE PROTECTOR FAULT:

1. A 120V main surge protector fault in the new RTU control panel (JAL-128) shall be annunciated at the OIT and SCADA HMI.

O. LOOP 130: SECURITY SYSTEM ALARMS

1. The following security system alarms shall be hardwired into the RTU PLC and displayed/annunciated at the OIT and the SCADA HMI:

a. Station intrusion alarm (YA-130A)

b. Generator enclosure intrusion alarm (YA-130B)

d. Station fire alarm (YA-130C)

e. Station help call (YA-130D)

f. System trouble (YA-130E)

P. LOOP 135: STATION FLOOD ALARM

1. A float switch (LSH-135A) will be located in the suction pipe trench and shall be hardwired into the RTU PLC. When activated the alarm shall be annunciated at the OIT and the SCADA HMI:

2. A float switch (LSH-135B) will be located in the discharge pipe trench and shall be hardwired into the RTU PLC. When activated the alarm shall be annunciated at the OIT and the SCADA HMI:

Q. LOOP 136: STATION TEMPERATURE MONITORING

1. A temperature indicating transmitter (TIT-136) located on the station's wall and shall be connected to the RTU PLC I/O via hardwired I/O. The temperature shall indicated at the OIT and SCADA HMI.

2. The temperature shall be trended and recorded (TIR-136) at the SCADA HMI.

3. Low and High temperature alarms (TAL-136 & TAH-136) shall be based on the OIT and SCADA HMI entered temperature alarm setpoints.

R. LOOP 140: HVAC SYSTEM MONITORING

1. The following HVAC system status and alarms shall be hardwired into the RTU PLC and displayed/annunciated at the OIT and the SCADA HMI:

a. RTU-1, HVAC Unit running (YI-140)

b. RTU-1, HVAC Unit Alarm (YA-140)

S. LOOP 145: EJECTOR PUMP MONITORING

1. The following Ejector Pump alarms shall be hardwired into the RTU PLC and annunciated at the OIT and the SCADA HMI:

a. Pump fail (YA-145A)

b. High level alarm (YA-145B)

PART 2 – PRODUCTS

2.01 INSTRUMENTATION GENERAL

A. All equipment shall be of the latest proven design. First generation equipment with less than three years general use shall have documentation on construction operation, field test and user list.

B. All equipment shall be suitable for operation in the environment of the Project.

C. Transmission to and from analog devices shall be 4-20 mAdc.

D. All signal converters, isolation transformers, uninterruptible power supplies (UPS), power regulators, or power converters shall be the responsibility of the instrument supplier. The loop descriptions herein do not specify all hardware required for proper operation. It is the responsibility of the Instrumentation supplier to furnish and install all necessary equipment for complete systems.

E. All equipment necessary to complete the functional requirements of this Section shall be supplied by the Instrumentation and Control System Supplier and be of the same manufacturer unless otherwise specified (e.g. signal converters, integrators, computing devices alarm trips etc.) shall be of the same manufacturer as the recorders, controllers and indicators.

F. All necessary fuses or switches required by the Instrumentation and Control System Supplier for his equipment shall be provided with the equipment. All instruments requiring an external power supply shall have an internal ON-OFF switch.

G. Indicator, recorders, controllers, integrators, relays, and other receiving devices, when operating in a loop shall be of a design such that a failure of an individual device shall not effect the operation and integrity of the remaining loop functions. All indicators, recorders either remote or panel mounted shall have an individual internal on/off switch.

H. Electronic transmitting equipment shall provide loop power. True 2-wire transmitter may have its loop power supplied in the receiving instrument, if available, or by a plug in power supply mounted in the receiving instrument panel.

I. All conductors running from the field to the control panel shall be of a single, continuous length, without splices except at approved junction boxes. The junction boxes shall have terminal blocks with 20 percent spares in addition to terminals for all wires including spare wires. Special care shall be exercised to carry grounding lines through such junction boxes with the least possible resistance.

J. Multi-conductor cable may be used between junction boxes and control panels.

K. All shielded cable shall be grounded at the control panel end only. Shields shall be carried through junction boxes with the least possible resistance and kept isolated from ground at these points. The field end of the shield shall be insulated to prevent grounding.

L. All field electronics and outdoor control panel equipment shall be suitable for operation in ambient temperatures of -40 degrees F to 140 degrees F. All indoor control panel located electronics shall be suitable for operation in ambient temperatures of 40 degrees F to 120 degrees F.

M. All external connection points shall be made at terminal blocks with No. 6-32 or larger screws.

N. Nameplates shall be provided on all field mounted transmitters, level relays, control panels, indicators, etc. Nameplates shall be identical to those specified for Control Panels.

2.02 CONTROL PANELS

A. Control panels shall be per the control panel list at the end of this Section.

B. Control panels shall be fabricated per drawings I-001, and I-101 thru I-110 and specification 17320.

2.03 PROGRAMMABLE LOGIC CONTROLLERS (PLC's):

A. PLC equipment shall be furnished and installed per drawings I-001, and I-101 thru I-110 and specification 17320.

B. The PLC programming shall be provided by the owner.

2.04 OPERATOR INTERFACE TERMINAL (OIT)

A. OIT equipment shall be furnished and installed per drawings I-001, and I-101 thru I-110 and specification 17320.

B. The OIT programming shall be provided by the owner.

2.05 EQUIPMENT

A. The INSTRUMENT LOOP DESCRIPTION, DIAGRAMS, AND INSTRUMENT LIST included at the end of this section indicate the intent of the process and interconnection between INSTRUMENTS. EQUIPMENT specified herein does not purport to cover all equipment that may be required to complete the process intent. Numbering identification is based on ISA standard. The instrument index sheets included within this section of the specifications have been furnished to summarize the system equipment and to list the operating parameters for this equipment. This list may not completely include all the required equipment necessary for a completely operational system. The instrument supplier shall provide all necessary equipment required in order to perform the function for the system.

B. INDUSTRIAL ETHERNET SWITCH

1. The industrial Ethernet Switch shall be furnished and installed per drawings I-001, and I-101 thru I-107 and specification 17320.

C. ELECTRICAL RELAYS

1. Electrical relays for handling power circuits shall be general purpose equal to IDEC, Omron, Allen-Bradley, Potter & Brumfield, or approved equal. Relays handling control, telemetering or alarm functions shall be general-duty, plug-in type, complete with dust and moisture proof enclosure equal to IDEC, Omron, Allen-Bradley, Phoenix Contact, Potter & Brumfield, or approved equal. Units shall be provided with integral indicating light to indicate if relay is energized. Units shall have DPDT relay contacts and be rated for 10 A at 120 VAC, 10 A at 24 VDC

2. Time delay relays shall have DPDT relay contacts and be suitable for on-delay or off-delay operation. Rated load shall be 10 A at 120 VAC, 10 A at 24 VDC. Units shall be provided with integral time-delay adjustment knob. Relays shall be provided with dust and moisture resistant covers. Relays shall be suitable for operating in a temperature range from -30° to 55° C. Units shall be adjustable and available in a single range or multiple ranges from 0.1 second to 10 hours.

Time delay relays shall be UL listed. Mounting sockets matched to relay and mounting rails/holders shall be provided as required. Time delay relays shall be as manufactured by IDEC, Allen Bradley, or Engineer-approved equal.

D. CURRENT-TO-CURRENT CONVERTERS

1. Current to current converters shall transform a current input signal (1-5, 4-20, or 10-50 mA) to a proportional 4-20 mA current output signal. The unit shall be of solid state electronic circuitry sealed in a protective epoxy compound, and shall be for surface or rear of panel mounting.

2. Current to current converters shall provide signal conversion capabilities, input/output isolation and output power boosting.

3. Signal output drive capability shall be 4-20 mA into 600 ohms load.

4. Accuracy shall be 0.25 percent of span.

E. LIGHTNING/SURGE PROTECTION

1. Lightning/surge protection shall be provided to protect the instrumentation system from induced surges propagating along the signal and power supply lines. The protection systems shall be such that the protective level shall not interfere with normal operation, but shall be lower than the instrument surge withstand level, and be maintenance free and self-restoring. Ground wires for all surge protectors shall be connected to a good earth ground and where practical each ground wire run individually and insulated from each other.

2. Protection of all 120 volt AC instrument cabinet power supply lines and individual field instruments shall be provided. Cabinets shall be protected by isolation transformers and surge suppressers.

3. The unit shall be back panel mounted and is to be connected between the telephone line and the telemetry and control equipment. Transient voltages above 90V line to ground or 180V line to line will cause the gas discharge tubes to short to ground. If the peak lasts more than an instant, 1/4 amp fast blow fuses will open the line.

4. Protection of circuits connected over leased or private telephone lines shall be provided with surge and lightning protectors at signal terminal in addition to the normal fused lightning arrestor supplied by the telephone company.

5. Lightning/surge protection units shall be as manufactured by Josyln Industries or equal.

6. All remote loop powered transmitters shall be provided with close-nippled lightning/surge protection units. The loop shall be terminated at the receiving device/panel with a receiving end lightning/surge protection unit. This shall be provided to all remote equipment for this project.

F. POWER SUPPLIES

1. The Power Supplies shall be furnished and installed per drawings I-001, and I-101 thru I-110 and specification 17320.

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G. Indicating Lights: Indicating lights shall be 30 mm NEMA, high-intensity LED, push-to-test type, by Allen-Bradley or Engineer approved equal.

2.06 PRESSURE INDICATING TRANSMITTER (ABSOLUTE, GAUGE)

A. Type: Two-wire, capacitance or solid-state based; high performance "SMART" microprocessor pressure transmitter with HART based digital communications capabilities.

B. Operation Purpose: To sense pressure and produce a standard current output signal linear with absolute or gauge pressure; indicator - integrally mounted and scaled in engineering units; manifold - stainless steel three (3) valve type.

C. Functional: Power supply - DC (loop powered); output - 4-20 mA DC; communications protocol - HART; accuracy - ±0.1% of span; integral non-interactive zero and span adjustments; integral LCD indicator of process value in engineering units; non-volatile memory; self diagnostic capability.

D. Physical: Wetted parts - 316 SS, glass filled TFE; seals – Teflon coated; diaphragm – silicone filled; electronics housing - NEMA 4X; process connection – ½ inch NPT; conduit connection – ½-in NPT; wiring connection – screw terminals; mounting – 2 inch pipe mounting bracket; manifold – integral 316 SS 3-valve plus plug.

2.07 PRESSURE DIFFERENTIAL FLOW INDICATING TRANSMITTER

A. Type: Two-wire, capacitance or solid-state based; high performance "SMART" microprocessor pressure transmitter with HART based digital communications capabilities.

B. Operation Purpose: To sense differential pressure across a venture tube and produce a standard current output signal linear with the flow rate; indicator - integrally mounted and scaled in engineering units; manifold - stainless steel three (3) valve type.

C. Functional: Power supply - DC (loop powered); output - 4-20 mA DC; communications protocol - HART; accuracy - ±0.1% of span; integral non-interactive zero and span adjustments; integral LCD indicator of process value in engineering units; non-volatile memory; self diagnostic capability.

D. Physical: Wetted parts - 316 SS, glass filled TFE; seals – Teflon coated; diaphragm – silicone filled; electronics housing - NEMA 4X; process connection – (2) ½ inch NPT; conduit connection – ½-in NPT; wiring connection – screw terminals; mounting – 2 inch pipe mounting bracket; manifold – integral 316 SS 3-valve plus plug.

2.08 LEVEL SWITCH - FLOAT TYPE

A. Float switches shall be of non-mercury snap switch type, completely metal capsules rated for switching 14 ampere loads at 120 VAC that activates at 2" of water. Switches shall

be made of high impact plastic with detachable floor mounting base and over protective cover. Switches shall include 28” of marine grade No. 14 AWG wire. Switches shall be installed per the manufacturer's requirements.

B. Level switches shall be model 40A as manufactured by Rule, or equal.

2.09 TEMPERATURE INDICATING TRANSMITTER

A. The temperature indicating transmitter shall provide a 4-20 mA output that is linear to the measured ambient temperature, with a temperature sensing range of 0 to 100 degrees Fahrenheit. Accuracy shall be 0.5% of the span. Temperature sensor shall have a local LED display of temperature. The temperature sensor shall be UL listed.

B. Temperature indicating transmitter shall be loop powered, 13 to 40 vDC.

C. Temperature indicating transmitter shall be Model RTTI as manufactured by Devar, Inc. or equal.

2.10 DATA LOGGING CIRCULAR CHART RECORDER

A. Type: Multiple print head microprocessor-based circular chart recorder with totalizer.

B. Operation: To accept two (4) 4-20 mA DC input signals and data log the inputs signals on a circular paper chart via (4) separate color chart pens. The following signals shall be the inputs to the chart recorder:

1. Station Discharge Flow (FIT-111), provide with flow totalizer.

2. Station Discharge Pressure (PIT-110).

3. Water Storage Tank Level (LT-104).

C. Functional:

1. Power – 120VAC ±10%, 50/60 Hz, maximum power consumption of 25 VA

2. Input - 4-20 mA DC into 250 ohms

3. Indication – 40 character display and keyboard

4. Charts - 12 hour, 24 hour, or 7 day, configurable 1 to 4096 hours/revolution.

5. Memory protection – configuration save in EEPROM.

D. Physical: case size nominal 15.0-in wide by 15.0-in wide by 8-in deep suitable for wall mounting.

E. Performance:

1. Input: ±1% of resolution , ±0.01% of operating gain span.

2. Pen position resolution: ± 0.02% of operating gain span.

3. Display accuracy: second to full scale.

F. Data Logging: The chart recorder shall be provided with a 6MB PC SRAM memory card and a card driver.

E. Signal Retransmission: The recorder shall retransmit three configurable isolated 4-20 mA signals based on the input signals.

G. Accessories: Furnish a one-year supply of pens, and a one-year supply of 24-hour charts and 7-day charts. Furnish as required 250 ohm input current shunts.

2.11 RADIO TELEMETRY EQUIPMENT

A. Radio Modem: The existing Cap-Amp Viper Radio modem in the existing pump station's RTU shall be removed, re-utilized, and mounted in the new RTU control panel.

B. Antenna

1. The existing antenna for the existing pump station's RTU shall be removed, re-utilized, and connected into the new RTU control panel.

2. Antenna shall be provided with a new base mounting equipment with pass through cable connection and NPT threaded nipple for connection to 1 ¼" rigid conduit.

C. Antenna Cable

1. Provide LMR400 or engineer approved equal coaxial antenna cables of sufficient length to connect the antenna to the radio IP router at each site. Antenna cables shall be installed within the conduit. Provide VHF50HN Polyphaser, or Engineer approved equal, surge protection equipment for the antenna cable at each site.

2. Cabling to the antenna from the radio IP router shall be run in conduit in accordance with DIVISION 16 - ELECTRICAL requirements, to provide for physical protection from damage.

D. Surge Protection Equipment

1. Provide a PolyPhaser or equal lightning arrestor for connection to the antenna cable installed in a dedicated junction box panel. The lightning arrestor shall meet the following requirements:

a. Throughput energy: less than or equal to 600 µJ for a 50kA 8/20 µs waveform

b. Insertion loss: less than or equal to 0.1 dB over the frequency range

2.12 SPARE PARTS

A. Spare parts shall be provided as a part of the start-up services during the initial start-up and phase-in period. These items shall include the spare parts as required by specification 17320 and accessories such as fuses, circuit breakers, power supplies, I/O cards, lights, etc. required to start-up and operate the system for a period of 60 days. These items shall be packaged in separate containers and shipped to the job site with the instruments and shall be tagged "INSTRUMENT START-UP EQUIPMENT".

B. Spare parts above and beyond those being provided for start-up services shall be provided under this Section. All spare parts shall be packaged and shipped at one time. Separate shipment of spare parts shall not be acceptable. The Engineer shall be notified of the shipment release in writing indicating that all items have been shipped. Each item shall be checked by the Engineer as being received and that all components have been provided as specified.

C. Furnish one box of spare fuses of each type supplied. A box shall consist of a minimum of 12 fuses.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Instrumentation and accessory equipment shall be installed in accordance with the best field and shop practices.

B. The workmanship shall be in accordance with the best field shop practices for the instrument and control systems.

C. All workmen shall be skilled in the work to which they are assigned and all work shall be performed under the direct supervision of an experienced and competent instrument foreman.

D. All wiring and piping shall be constructed perfectly plumb, square, level, and true to lines and surfaces indicated in a neat, substantial and workmanlike manner, and in such a way as to properly serve for the purpose intended. All members and parts, upon installation, shall be properly framed, secured together and anchored in place. All cuts shall be deburred and immediately cleaned from opposite end before connecting.

E. All instruments shall be mounted, piped and connected in strict accordance with the manufacturer's instructions.

F. All internal wiring of the instrument panel shall be done by the panel manufacturer in accordance with the drawings and instrument manufacturer's instructions.

G. The loops on the drawings and the instrument specifications and index sheets indicate the intent of the interconnections between and the type of individual instrument. The proposed equipment shall be complete with all mounting hardware and accessories to satisfy the functional requirements.

H. All work shall be executed in full accordance with codes and local rulings. Should any work be performed contrary to said rulings, ordinances and regulations, the Instrumentation Contractor shall bear full responsibility for such violations and assume all costs arising therefrom.

I. All piping to and from field instrumentation shall be provided with necessary unions, test tees and shut-offs.

J. Interfacing fixtures shall be compatible with the equipment to which they are attached and shall comply with the applicable specifications.

K. In-line devices, flow or level elements, specified herein shall be installed under DIVISION 15 - MECHANICAL.

L. Wiring of in-line devices, flow or level elements, specified herein shall be installed under DIVISION 16 - ELECTRICAL.

M. Coordination with the process and equipment in addition to standard quoted fixtures require to conform the instrumentation to the process shall be the responsibility of the General Contractor. The Instrumentation Contractor shall provide detail information on the fixtures being supplied and the extent of the field installation required.

N. Brackets and hangers required for mounting of equipment shall be provided as noted on the drawings or as required. They shall be done in a workmanlike manner and not interfere with any other equipment.

O. Investigate each space in the building through which equipment must pass to reach its final location. If necessary, the manufacturer shall be required to ship his material in sections sized to permit passing through such restricted areas in the building.

P. The shield on each process instrumentation cable shall be grounded as directed by the manufacturer of the instrumentation equipment but in no case shall more than one ground be employed for each shield.

Q. Maximum practical separation shall be maintained between signal (analog, alarm, and status) conduits and power feeders and AC systems.

R. All conductors running from the field to the control panel shall be a single, continuous length without splices, except at approved junction boxes. The junction boxes shall have terminal blocks with 20% spare in addition to terminals for all wires including spare wires. Special care shall be exercised to carry grounding lines through such junction boxes with the least possible resistance.

S. Multi-conductor cable may be used between junction boxes and control panels.

T. All field conductors shall terminate at the control panel terminal board. Millivolt signal wires (i.e., thermocouple) may be connected direct to the input terminals of the receiving instrument if so specified.

U. All wire ends shall be terminated with hook fork type non-split compression lugs.

V. All wire ends shall be identified at both ends with wire markers.

W. Entry to field enclosures shall be through the back, side, or bottom (not top) with weatherproof hubs. Wiring shall enter near the terminal point and not obstruct access to removal of components.

X. Lifting rings from cabinets/assemblies shall be removed. Hole plugs shall be provided for the holes of the same color as the cabinet.

3.02 START-UP

A. Prior to final connection to the main instrument control panel, the Instrumentation Contractor shall thoroughly clean all work completed including the interior of all panelboards; and remove all dirt, trash, and foreign material. The outside of all instrument panelboards are to be cleaned and damaged painted surfaces touched up as required to leave the equipment in an acceptable condition. This shall include all nameplates, tags, and identification of equipment and devices within or on the front of the panels.

B. It shall be the responsibility of the vendor to provide a factory trained and qualified serviceman from the manufacturer's of the equipment to TEST AND CALIBRATE ALL EQUIPMENT and to INSTRUCT the Contractor on EQUIPMENT INSTALLATION and the ENGINEER on operation of the equipment.

C. No other instrumentation system manufacturer's personnel other than those persons directly from the service department of the manufacturer of the equipment shall be acceptable to perform this work.

D. The start-up services shall be performed by qualified personnel from the service department of the equipment manufacturer with a minimum of five years experience on the equipment being provided by this contract, or equal.

E. During the start-up, the Instrumentation shall provide sufficient personnel to aid with the start-up of the instrument and control equipment to be provided and installed by this Section and by this Contract. This shall include services to correct any faults and to make the necessary adjustments for the proper operation of the equipment and installation.

3.03 TESTING AND CALIBRATING

A. Testing and calibration of equipment shall be done in the presence of the Engineer.

B. Prior to electrical check out all breakers, switches and similar disconnect devices shall be placed in the off position.

C. The panel and other equipment grounding shall be verified.

D. Visual inspection and continuity testing shall be made to verify that no damaging wiring errors occur between power and signal wiring.

E. The systems shall be checked for improper or accidental grounding.

F. Each system and component shall be energized and their inputs simulated. The output shall be checked to verify the proper calibration and interaction with associated hardware.

G. Hypotting shall not be permitted on instrument systems unless specific instructions are given to safeguard electronic equipment from damage.

H. Prior to actuating a final control element (valve, level actuator, or variable frequency drive) the Instrumentation Contractor shall obtain the permission of the General Contractor and any other involved contractors to prevent damage to associated equipment.

I. The factory serviceman shall verify the calibration and direction of the final control element in accordance with the requirements for each portion of the system.

J. Instrument and control calibration and control loop checkout shall be the responsibility of the manufacturer of the equipment.

K. The Instrumentation Contractor shall arrange for and obtain the services of a factory trained service qualified engineer from the manufacturer's of the equipment to perform the calibration and commissioning of the entire system.

L. Each instrument shall be calibrated at 10 percent, 50 percent, and 90 percent using test instruments that are rated to an accuracy of at least five times greater than the instrument being checked. The test instrument shall have its accuracy traceable to the National Bureau of Standard as applicable.

M. Upon completion of the work, the Instrumentation Contractor shall demonstrate to the Owner the proper operation of all equipment and systems.

N. The Instrumentation Contractor submit to the Engineer all test data, inspection test certificates, manufacturers' warranties certified calibration data, certified prints, manufacturers' installation, operation and maintenance manuals, electrical wiring and control diagrams with all noted field modification for an as-built record for the system, and required and suggested spare parts lists.

O. A factory test shall be scheduled by the instrumentation system manufacturer for the entire system. A simulated system layout which shall include all equipment and interconnections shall be arranged to perform all system functions. The testing shall be performed in the presence of the Engineer. A two week written notification shall be provided to the Engineer to allow for scheduling the testing.

P. Upon completion and satisfactory performance an approval notification shall be provided for this portion of the work for this Section. No equipment shall be allowed to be shipped from the factory without approval for this portion of the work.

3.04 MANUFACTURER'S SERVICES

A. The supervisory service of a factory-trained service engineer who is specifically trained on the type of equipment herein specified shall be provided for a period of not less than four 8-hour days during construction to assist the Instrumentation and Electrical Contractors in equipment installation, the location of sleeves, methods of installing conduit and special cable, mounting, piping and wiring of one of each type of device, and the methods of protecting all of the equipment prior to placing it into service. Upon completion of the installation, the services of the above service engineer shall be provided for a period of not less than six 8-hour days for calibration, testing and start-up of the equipment. The instrumentation system supplier shall conduct a group training program on the operation and routine maintenance of the system. The training shall be conducted at the installation site and consist of five classroom and field training sessions, 8 hours a day during normal working hours. The text shall be the loop diagrams, operation and maintenance manual and shall concentrate on the operation of the equipment as applied to this process. The minimum days specified above do not relieve the manufacturer of providing sufficient service to place the system in satisfactory operation.

3.05 PRODUCT HANDLING

A. Upon completion of shop assembly and testing, all control panels shall be enclosed in heavy-duty polyethylene envelopes or secured sheeting to provide complete protection from dust and moisture. Dehumidifiers shall be placed inside the polyethylene coverings. The equipment shall then be skid-mounted for final transport. Lifting rings shall be provided for moving the equipment without removing protective covering. Boxed weights shall be shown on shipping tags together with instructions for unloading, transporting, storing and handling at the job site.

B. Special instructions for proper field handling and installation required by the manufacturer for proper protection shall be securely attached to each piece of equipment prior to shipment.

C. Each package shall be tagged to identify its location, tag number and function in the system. Identification shall be prominently displayed on the outside of the package.

D. A permanent stainless steel or other noncorrosive material tag firmly attached and permanently and indelibly marked with the instrument tag number as given in the tabulation shall be provided on each piece of equipment supplied under this section.

E. Equipment shall not be stored out-of-doors. Equipment shall be stored in dry permanent shelters and, including in-line equipment, shall be adequately protected against mechanical injury. If any apparatus has been damaged, such damage shall be repaired or the damaged equipment replaced by the Instrumentation Contractor at his own cost and expense. If any apparatus has been subject to possible injury by water, it shall be thoroughly dried out and put through such tests as directed by the Engineer. This shall be at the cost and expense of the Instrumentation Contractor or the apparatus shall be replaced by the Instrumentation Contractor at his own expense.

3.06 GUARANTEE

A. For guarantee, refer to General Conditions.

CONTROL PANEL AND OPERATOR STATION LIST										
Designation	**Description**	**Location**	**NEMA Rating**	**Material**	**Min. Height**	**Min. Width**	**Min. Depth**	**Mounting**	**UPS**	**OIT**
RTU-1	Edgell Pump Station SCADA RTU	Edgell Station	4	Steel	48-in	36-in	12-in	Wall	YES	YES

INSTRUMENTATION LIST								
TAG #	**FACILITY**	**FUNCTION**	**INSTRUMENT**	**TYPE**	**LOCATION**	**RANGE**	**UNITS**	**REMARKS**
PIT-100	Edgell Pump Station	Station Suction Pressure	Pressure Ind/Transmitter	Electronic Absolute Pressure	Suction Water Pipe	0-150	PSI	-
UIR-105	Edgell Pump Station	Chart Recorder	Data Logging Chart Recorder	Electronic Chart Recorder	Pump Room	N/A	N/A	-
PIT-110	Edgell Pump Station	Station Discharge Pressure	Pressure Ind/Transmitter	Electronic Absolute Pressure	Discharge Water Pipe	0-150	PSI	-
FIT-111	Edgell Pump Station	Station Metering Flow	Flow Ind/Transmitter	Electronic Pressure Differential	Discharge Water Pipe	0-5,000	GPM	-
LSH-135A	Edgell Pump Station	Station Flood	Level Switch	Float Switch	Suction Pipe Trench	N/A	N/A	-
LSH-135B	Edgell Pump Station	Station Flood	Level Switch	Float Switch	Suction Pipe Trench	N/A	N/A	-
TIT-136	Edgell Pump Station	Station Temperature	Temperature Ind/Transmitter	Electronic	Pump Room	0-100	Degrees F	-

IO AND ALARM LIST											
IO Tag No	**Service**	**Location**	**IO Description**	**IO Type**	**IO Signal Range**	**CP Termination**	**LRL**	**URL**	**Units**	**Alarm List**	**Remarks**
PIT-100	Station Suction Line	Edgell Pump Station	Suction Line Pressure	AI	4-20 mA DC	RTU-1	0	150	PSI	TRUE	PAHH, PAH, PAL, PALL
YI-101A	Booster Water Pump #1	Edgell Pump Station	Pump #1 HOA in Auto	DI	--	RTU-1	--	--	--	FALSE	--
YI-101B	Booster Water Pump #1	Edgell Pump Station	Pump #1 Run Status	DI	--	RTU-1	--	--	--	FALSE	--
TAH-101	Booster Water Pump #1	Edgell Pump Station	Pump #1 Temperature High	DI	--	RTU-1	--	--	--	TRUE	--
YA-101A	Booster Water Pump #1	Edgell Pump Station	Pump #1 VFD Alarm	DI	--	RTU-1	--	--	--	TRUE	--
SI-101	Booster Water Pump #1	Edgell Pump Station	Pump #1 VFD Speed	AI	4-20 mA DC	RTU-1	0	100	%	FALSE	--
YS-101	Booster Water Pump #1	Edgell Pump Station	Pump #1 Start/Stop	DO	--	RTU-1	--	--	--	FALSE	--
SC-101	Booster Water Pump #1	Edgell Pump Station	Pump #1 VFD Speed Command	AO	4-20 mA DC	RTU-1	30	100	%	FALSE	--
YI-102A	Booster Water Pump #2	Edgell Pump Station	Pump #2 HOA in Auto	DI	--	RTU-1	--	--	--	FALSE	--
YI-102B	Booster Water Pump #2	Edgell Pump Station	Pump #2 Run Status	DI	--	RTU-1	--	--	--	FALSE	--
TAH-102	Booster Water Pump #2	Edgell Pump Station	Pump #2 Temperature High	DI	--	RTU-1	--	--	--	TRUE	--
YA-102	Booster Water Pump #2	Edgell Pump Station	Pump #2 VFD Alarm	DI	--	RTU-1	--	--	--	TRUE	--
SI-102	Booster Water Pump #2	Edgell Pump Station	Pump #2 VFD Speed	AI	4-20 mA DC	RTU-1	0	100	%	FALSE	--
YS-102	Booster Water Pump #2	Edgell Pump Station	Pump #2 Start/Stop	DO	--	RTU-1	--	--	--	FALSE	--
SC-102	Booster Water Pump #2	Edgell Pump Station	Pump #2 VFD Speed Command	AO	4-20 mA DC	RTU-1	30	100	%	FALSE	--

IO AND ALARM LIST											
IO Tag No	**Service**	**Location**	**IO Description**	**IO Type**	**IO Signal Range**	**CP Termination**	**LRL**	**URL**	**Units**	**Alarm List**	**Remarks**
YI-103A	Booster Water Pump #3	Edgell Pump Station	Pump #3 HOA in Auto	DI	--	RTU-1	--	--	--	FALSE	--
YI-103B	Booster Water Pump #3	Edgell Pump Station	Pump #3 Run Status	DI	--	RTU-1	--	--	--	FALSE	--
TAH-103	Booster Water Pump #3	Edgell Pump Station	Pump #3 Temperature High	DI	--	RTU-1	--	--	--	TRUE	--
YA-103	Booster Water Pump #3	Edgell Pump Station	Pump #3 VFD Alarm	DI	--	RTU-1	--	--	--	TRUE	--
SI-103	Booster Water Pump #3	Edgell Pump Station	Pump #3 VFD Speed	AI	4-20 mA DC	RTU-1	0	100	%	FALSE	--
YS-103	Booster Water Pump #3	Edgell Pump Station	Pump #3 Start/Stop	DO	--	RTU-1	--	--	--	FALSE	--
SC-103	Booster Water Pump #3	Edgell Pump Station	Pump #3 VFD Speed Command	AO	4-20 mA DC	RTU-1	30	100	%	FALSE	--
LT-104	Storage Tank Level- Chart Recorder Input	Remote Storage Tank	Storage Tank Level	AO	4-20 mA DC	RTU-1	0	50	FEET	FALSE	--
PIT-110	Station Discharge Line	Edgell Pump Station	Discharge Line Pressure	AI	4-20 mA DC	RTU-1	0	150	PSI	TRUE	PAHH, PAH, PAL, PALL
FIT-111	Station Discharge Line	Edgell Pump Station	Discharge Line Flow	AI	4-20 mA DC	RTU-1	0	5,000	GPM	TRUE	FAHH, FAH, FAL, FALL
ZSO-115	Pressure Relief	Edgell Pump Station	Pressure Relief Valve Open	DI	--	RTU-1	--	--	--	TRUE	--
YA-120A	Generator	Edgell Pump Station	Generator Failure	DI		RTU-1	--	--	--	TRUE	--
YA-120B	Generator	Edgell Pump Station	Generator Alarm	DI		RTU-1	--	--	--	TRUE	--
YA-120C	Generator	Edgell Pump Station	Generator Low Fuel Level	DI		RTU-1	--	--	--	TRUE	--
YA-120D	Generator	Edgell Pump Station	Generator Fuel Tank Leak	DI		RTU-1	--	--	--	TRUE	--
YI-120A	Generator	Edgell Pump Station	Generator On	DI		RTU-1	--	--	--	FALSE	--
YI-120B	Generator	Edgell Pump Station	Generator Not in Auto	DI		RTU-1	--	--	--	FALSE	--
YI-121A	Transfer Switch	Edgell Pump Station	Normal Position	DI		RTU-1	--	--	--	FALSE	--

IO AND ALARM LIST											
IO Tag No	**Service**	**Location**	**IO Description**	**IO Type**	**IO Signal Range**	**CP Termination**	**LRL**	**URL**	**Units**	**Alarm List**	**Remarks**
YI-121B	Transfer Switch	Edgell Pump Station	Emergency Position	DI		RTU-1	--	--	--	FALSE	--
YI-121C	Transfer Switch	Edgell Pump Station	Los of Utility Power	DI		RTU-1	--	--	--	TRUE	--
JAL-125	SCADA RTU	Edgell Pump Station SCADA RTU	120VAC Power Failure	DI	--	RTU-1	--	--	--	TRUE	--
JAL-126	SCADA RTU	Edgell Pump Station SCADA RTU	Power Supply Failure	DI	--	RTU-1	--	--	--	TRUE	Power Supply Alarms are wired in series.
JAL-127	SCADA RTU	Edgell Pump Station SCADA RTU	UPS Ready	DI	--	RTU-1	--	--	--	FALSE	--
JAL-127A	SCADA RTU	Edgell Pump Station SCADA RTU	UPS Replace Batteries	DI	--	RTU-1	--	--	--	TRUE	--
JAL-127B	SCADA RTU	Edgell Pump Station SCADA RTU	UPS Buffering	DI	--	RTU-1	--	--	--	TRUE	--
JAL-128	SCADA RTU	Edgell Pump Station SCADA RTU	120V Main Surge Protector Fault	DI	--	RTU-1	--	--	--	TRUE	--
YA-130A	Station Building Intrusion	Edgell Pump Station Fire/Security Panel	Station Intrusion	DI		RTU-1	--	--	--	TRUE	--
YA-130B	Generator Intrusion	Edgell Pump Station Fire/Security Panel	Generator Enclosure Intrusion	DI		RTU-1	--	--	--	TRUE	--
YA-130C	Station Fire	Edgell Pump Station Fire/Security Panel	Station Fire	DI		RTU-1	--	--	--	TRUE	--
YA-130D	Station Help Call	Edgell Pump Station Fire/Security Panel	Station Help Call	DI		RTU-1	--	--	--	TRUE	--
YA-130E	Security System	Edgell Pump Station Fire/Security Panel	Security System Trouble	DI		RTU-1	--	--	--	TRUE	--
LSH-135A	Station Flood	Edgell Pump Station Suction Pipe Trench	Station Flood	DI	--	RTU-1	--	--	--	TRUE	--
LSH-135B	Station Flood	Edgell Pump Station Discharge Pipe Trench	Station Flood	DI	--	RTU-1	--	--	--	TRUE	--
TIT-136	Station Temperature	Edgell Pump Station	Station Temperature	AI	4-20 mA DC	RTU-1	0	100	F	TRUE	TAH, TAL
YI-140	HVAC RTU	HVAC RTU	HVAC RTU Running	DI		RTU-1	--	--	--	FALSE	--

IO AND ALARM LIST											
IO Tag No	**Service**	**Location**	**IO Description**	**IO Type**	**IO Signal Range**	**CP Termination**	**LRL**	**URL**	**Units**	**Alarm List**	**Remarks**
YA-140	HVAC RTU	HVAC RTU	HVAC RTU Alarm	DI		RTU-1	--	--	--	TRUE	--
YA-145A	Ejector Pump	Ejector Pump Control Panel	Pump Fail	DI		RTU-1	--	--	--	TRUE	--
YA-145B	Ejector Pump	Ejector Pump Control Panel	High Level Alarm	DI		RTU-1	--	--	--	TRUE	--

Notes:

1. The IO and Alarm List contains a list of the physical IO points. Refer to the Loop Descriptions in this Section for additional IO points. For example, elapsed time meters (KQI-xxx), flow totalizers (FQI-xxx), motor state disagreement alarms (YA-xxx), software-based selector switches, start/stop or reset pushbuttons (HS-xxx), software-based timers (KC-xxx), level set points (LS-xxx), etc.

2. The IO point has one or more alarm points when "TRUE" appears in the "Alarm List" column. If no ISA identification letters appear in the "Alarm Remarks" column, then the alarm tag is the same as the tag in the "IO Tag No" column. When multiple sets of ISA identification letters appear in the "Alarm Remarks" column, create an alarm point for each set of ISA identification letters. Refer to the examples below. IO points with multiple alarm points are typical for *IT or *T ISA identification letters in the "IO Tag No" column, where * = first letter(s) of the set of ISA identification letters. Refer to the "Alarm Remarks" column for the specific alarms.

   *AHH = * alarm high high. Initially set at LRL + 90% of span rising, adjustable
   *AH = * alarm high. Initially set at LRL + 80% of span rising, adjustable
   *AL = * alarm low. Initially set at LRL + 20% of span falling, adjustable
   *ALL = * alarm low low. Initially set at LRL + 10% of span falling, adjustable
   d*/dt = high rate of change alarm. Initially set at 5% of span/second, adjustable
   *DAH = set point deviation alarm. Initially set at 5% of set point, adjustable

- END OF SECTION -

SECTION 17320

CONTROL SYSTEM EQUIPMENT PANELS AND RACKS

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes

1. Provide all wiring, labor, tools, materials, and equipment to furnish, install, and test control panels and enclosures in accordance with this Section, applicable reference standards listed in Article 1.03, and shop drawing level Drawings.

2. Work by Engineer (Woodard & Curran)

   a. PLC, OIT and HMI Programming

   b. Integration of radio-based SCADA telemetry system

B. Related Requirements

1. Section 17300 – Instrumentation and Controls

2. Division 16 Electrical – Specifications for electrical wiring standards and practices

1.02 PRICE AND PAYMENT PROCEDURES

A. Measurement and payment requirements: per Division 01 General Requirements.

1.03 REFERENCES

A. Reference Standards

1. American National Standards Institute (ANSI)

2. ASTM International (ASTM)

3. FM Global (FM)

4. International Society of Automation (ISA)

   a. ISA-RP60.3 Recommended Practice

5. National Electrical Code (NEC)

6. National Electrical Manufacturers Association (NEMA)

7. National Fire Protection Association (NFPA)

a. NFPA 70

b. NFPA 79 Electrical Standard for Industrial Machinery

8. Occupational Safety and Health Administration (OSHA)

9. Underwriters Laboratories (UL)

a. Standard 508A - Standard for Industrial Control Panels

B. Definitions

1. PLC – Programmable Logic Controller

2. RIO – Remote Input/Output Rack

3. OIT – Operator Interface Terminal

4. HMI – Human Machine Interface

5. RTU – Remote Terminal Unit

6. I/O – Input/Output

7. SCADA – Supervisory Control and Data Acquisition

8. Modules – devices that plug into a chassis or connect to an adjacent module and are keyed to allow installation in only one direction

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination, Sequencing, and Scheduling: per Division 01 General Requirements.

1. Coordinate equipment, and material delivery with Project schedule. Notify Engineer if delivery schedule of equipment, instruments, or material affects Project schedule. Include documentation from equipment Supplier indicating revised delivery schedule and reason for change.

1.05 SUBMITTALS

A. Submit in accordance with Division 01 General Requirements.

B. Product Data: as listed below unless letter regarding shop drawing level control panel Drawings is submitted per Paragraph 1.05.C.1. below.

1. Bill of materials (BOM) for each control panel, including panel tag name or number and component description, quantity, manufacturer name and model number for each component used in fabrication. BOM: keyed to easily correlate components shown in bill of materials with components shown on control panel equipment layout Drawings.

2. Manufacturer’s literature for each component identified on BOM. Clearly designate part number with highlights or arrows.

3. Equipment layout drawings for each control panel

4. Panel communication diagrams for each control panel

5. Power wiring diagrams for each control panel

6. Programmable logic controllers (PLC) input/output (I/O) wiring diagrams, on a module-by-module basis

C. Shop Drawings

1. Contractor may provide letter with copy of fabrication drawings confirming control panel fabricator will fabricate control panels as specified on shop drawing level control panel Drawings in lieu of Shop Drawings.

D. Closeout and Maintenance Material Submittals: per Division 01 General Requirements.

1. As-Built Drawings

a. After fabrication of control panels and factory acceptance testing is complete, panel shop shall provide Drawings of control panels, representing as-built conditions. Submit panel Drawings in AutoCAD DWG and Adobe PDF file formats, on USB drive or DVD-R media.

b. Submit with panels at delivery.

c. Contractor may provide legible red-line markups of shop level Drawings from panel shop if used in lieu of Shop Drawings.

1.06 QUALITY ASSURANCE

A. Provide in accordance with Division 01 General Requirements.

B. Qualifications: per Division 01 General Requirements and as follows.

1. Control panel fabricator/panel shop fabrication facility: UL 508A certified, in operation at least 5 years, regularly engaged in furnishing, installing, and wiring similar equipment for use in water and wastewater treatment facilities, and minimum of 3 projects of similar scope in past 5 years.

2. Surge protection: provided by manufacturer with minimum of 5 years' experience in production of this equipment.

C. Panel Shop

1. Following control panel fabrication, apply power to each panel to ensure panels are wired correctly and devices contained within panels power up correctly. Provide written confirmation that a power up test was completed.

2. Complete point-to-point wiring checkout for wiring contained in control panels and correct any errors or omissions found. Provide written confirmation that checkout was completed.

3. Provide Engineer 5 days' notice of completion of control panel fabrication and have control panels available in their facility for Factory Acceptance Test by Engineer or System Integrator. Control panels may not be shipped prior to execution of Factory Acceptance Test unless indicated in writing by Engineer.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Provide in accordance with Division 01 General Requirements and Section 13400.

1.08 SITE CONDITIONS

A. Existing Conditions: per Division 01 General Requirements.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Procurement of materials and manufacture of control panels shall not begin until related submittals have been reviewed and approved by the Engineer.

2.02 CONTROL PANEL COMPONENTS

A. PROGRAMMABLE LOGIC CONTROLLERS

1. PLC hardware and programming software: by same manufacturer.

2. Minimum PLC input/output (I/O) requirements as indicated on Drawings. Provide additional 20 percent active spare I/O wired to terminal blocks; relay outputs, wired to interposing relays.

3. Provide PLC rack or mounting space to accommodate additional 20 percent minimum spare slots for future expansion.

4. Provide microprocessor based PLC devices with power supplies, processors, process input and output modules, communication cards and chassis, mounted in control panel.

5. Size power supplies to accommodate analog signals, including spares, and card's entire I/O capacity.

6. Provide PLC capable of stand-alone operation in the event of SCADA network or SCADA computer failure.

7. Provide UL listed PLC system using modular, field expandable design.

8. Module design shall prohibit upside down insertion or connection of modules, and be compatible with processor type specified.

9. Operate programmable controller hardware at ambient temperature of 32-140 degrees F. Ambient temperature rating for storage: minus 40-185 degrees F.

10. Provide PLC hardware to function continuously in relative humidity range of 5-95 percent, non-condensing.

11. Provide PLC system designed and tested to operate in the high electrical noise environment of an industrial plant.

12. Module-expandable PLCs and associated modules

    a. Series processor acceptable level of quality: equivalent to Allen-Bradley CompactLogix 5380 series (5069-L306ER).

    b. Discrete input modules acceptable level of quality: equivalent to Allen-Bradley 5069-IB16.

    c. Discrete output modules acceptable level of quality: equivalent to Allen-Bradley 5069-OW16.

    d. Analog input modules acceptable level of quality: equivalent to Allen-Bradley 5069-IF8.

    e. Analog output modules acceptable level of quality: equivalent to Allen-Bradley 5069-OF8.

    f. Memory module acceptable level of quality: equivalent to Allen-Bradley 1784-SD1 and 1784-SD2.

B. OPERATOR INTERFACE TERMINALS

1. Operator interface terminal: color graphic display connecting directly to PLC communication port or a communication module, allowing viewing and changing of PLC parameters, rated NEMA 4/4X, powered by 24VDC with integrated real-time clock and battery backup.

2. Minimum OIT resolution of 1024 by 768 XGA graphics with 16-bit color graphics, touch screen operation. Minimum display size: 15” inch with display area of 11.97”inches by 8.98” inches.

3. Provide OIT with 82MB internal project memory with compact flash port. Provide 1 GB compact flash card for each operator terminal.

4. Provide OIT with real-time trending of process variables.

5. Provide OIT with active and historical alarm screens with ability to acknowledge and clear.

6. Provide OIT with ability to display a selectable screen based on specific alarm bits.

7. Provide all communication modules and cables for OIT - PLC communications. PLC interface: Ethernet/IP.

8. Provide and coordinate communications protocol drivers to establish reliable communications between PLC and OIT.

9. Provide OIT programming & configuration cables.

10. Provide OIT with licensed copy of programming software.

11. OIT acceptable level of quality: equivalent to Automation Direct 15-inch Color active-matrix TFT Touch Panel, part number EA9-T15CL-R.

C. Control Panel Components and Recommended Manufacturers

Control Panel Components	Expected level of quality: equivalent to listed manufacturers	Comments
Enclosures	Hoffman Hammond Saginaw APX	Suitable for use in environments where located per (NEMA, NFPA, etc.)
Wireway	Panduit Hoffman	
DIN Rail	Allen Bradley Phoenix Contact	
Radio Equipment	Calamp Viper SC200	Match existing Site standards.
Terminal Blocks	Allen Bradley Phoenix Contact Entrelec	Utilize 2-tier terminal blocks wherever possible to conserve panel space.
Terminal Block Fuse Holders	Allen Bradley Phoenix Contact Entrelec	Specify fuse holders with blown fuse indicators.
Circuit Breakers	Square D Allen Bradley	
120VAC Surge Suppressors	Phoenix Contact Square D	
Analog Surge Suppressors	Phoenix Contact Citel	
Media Converters	N-Tron B&B Electronics L-Com	Provide with DIN rail mount feature

Control Panel Components	Expected level of quality: equivalent to listed manufacturers	Comments
Fuses	Bussman Ferraz Shawmut	All glass fuses in control panels shall be fast acting style. Motor circuit protection and/or inductive load fuses shall be time delay style.
Control Relays	Allen Bradley Square D Omron	Include all required bases, hardware, etc.
Power Supplies	Sola Phoenix Contact Allen Bradley	Provide with power supplies sized as required for equipment contained within the enclosures and to supply field equipment connected to the enclosure.
Intrinsic Safety Barriers	Pepperl & Fuchs MTL Phoenix Contact	Discrete barriers shall be 2-channel barriers. Analog barriers shall be 2-wire barriers.
Ethernet Switches (Unmanaged)	Allen Bradley N-Tron Moxa	Switches shall be provided with direct-wired low voltage power source within the enclosure.
Ethernet Switches (Managed)	Allen Bradley N-Tron Moxa	All switches comprising the ring topology throughout the facility shall be provided from the same manufacturer.
Fiber Patch Panels	L-Com B&B Electronics	Provide with panel mount patch panels for incoming fiber optic cables as required
Emergency Power System	Allen Bradley Phoenix Contact Sola	Include uninterruptible power supply (UPS) in each control panel sized to furnish with at least 10 minutes of emergency power.
Panel Heaters	Hammond Hoffman	Provide with panel heaters for outside control panels where temperature is a concern for electronic components.
Receptacles	Pass & Seymour Hubbel Leviton	Provide with receptacle for UPS and convenience receptacle in each PLC control panel.
Pilot/Status Lights (Push to test)	Allen Bradley General Electric Square D	Color code as follows: Red-Fault, Green-Run
HOR, On/Off, L/R switches and push buttons	Allen Bradley General Electric Square D	Refer to Division 16. Furnish switches and push buttons with matching nameplate

2.03 SOURCE QUALITY CONTROL

A. Provide in accordance with Division 01 General Requirements.

PART 3 – EXECUTION

3.01 CONTROL PANEL FABRICATION

A. General

1. Fabricate panels per Shop level drawings.

2. Control panels shall include PLC, required I/O modules with chassis, if applicable, power supply, cables, and all appurtenances. Enclosures shall include switches, lights, annunciators and all appurtenances. Furnish panels and materials from one Supplier.

3. Provide electronic equipment utilizing printed circuitry and epoxy or equal coating to prevent contamination by dust, moisture, and fungus. Solid-state components: rated to provide reliable performance over ambient atmosphere fluctuations between 0 – 140 degrees F and 0 – 95 percent relative humidity, non-condensing. Field mounted equipment and system components: designed for installation in dusty, humid, and slightly corrosive service conditions.

4. Equipment installed in a hazardous area shall meet Class, Group, and Division to comply with the NFPA 70.

5. Provide heavy duty equipment, cabinets, and devices designed for continuous industrial service.

6. Fabrication requirements of control panels, enclosures, consoles, and cabinets.

   a. Size control panel enclosures to provide at least 20 percent spare space for future expansion.

   b. Provide PLC hardware to accommodate minimum 20 percent spare of each I/O type used in panel, wired to terminals and interposing relays during fabrication process.

   c. Provide control panel assemblies in compliance with UL 508A Standards.

B. Wiring

1. Interconnecting wiring: stranded and have 600-volt insulation.

2. Power distribution wiring on line side of fuses in accordance with Division 16.

3. Power and low voltage direct current (DC) wiring systems: routed in separate wireways. Crossing of power distribution wiring and control wiring: at right angles. Different system wires routed parallel to each other: separated by at least 6 inches. Different wiring systems shall terminate on separate terminal blocks. Wiring troughs may not be filled to more than 60 percent visible fill.

4. All wiring shall terminate onto single-or-double tier terminal blocks, where each terminal is sequentially numbered with a unique identifier. Direct interlock wiring between equipment is not allowed. Control panel: fabricated with minimum 20 percent spare terminals. Terminal blocks: arranged in vertical rows and separated into groups; power, alternating current (AC) control, DC signal. Terminal blocks: compression screw type. Spring-clamp style terminals will not be accepted.

    a. Discrete inputs (DI) and discrete outputs (DO) shall have 2 terminals per point with adjacent terminal assignments. Active and spare points: wired to terminal blocks.

    b. Analog inputs (AI) and analog outputs (AO) shall have a minimum of 3 terminals per shielded pair. Provide 3 terminals for direct connection of powered, 4-wire loops. Provide 4 terminals for direct connection of loop powered, 2-wire loops. Provide 5 terminals for connection of analog loops incorporating a local indicator or recorder. One terminal is for shielded ground connections for cable pairs. Ground the shielded signal cable at the PLC cabinet. Wire active and spare points to terminal blocks.

    c. Wire and tube markers in accordance with Division 16.

    d. Only 1 side of a terminal block row shall be used for internal wiring. Field wiring side of terminal shall not be within 6 inches of side panel or adjacent terminal, or within 8-inches of bottom of panel.

    e. Locate terminals for field wiring to reduce amount of routing through wireway to carry wiring to termination point.

5. Provide wiring, internal to panel and field wiring, with service loop to allow for future adjustment of termination point. Service loop: no more than 4-5 inches, stored in associated wireway.

6. Identify live circuit wiring, independent of the panel's normal circuit breaker protection.

7. All wiring shall be clearly tagged and color-coded in accordance with NEC. All tag numbers and color-coding shall correspond to panel wiring diagrams prepared by Engineer. All power wiring, control wiring, grounding, and DC wiring shall utilize different color insulation for each wiring system used. Utilize the following color coding scheme.

    a. Incoming 120 VAC Hot – Black

b. 120 VAC Hot Wiring (control circuit wires downstream of panel circuit breaker) – Red

c. 120 VAC Neutral – White

d. Ground – Green with yellow stripe

e. DC Wiring – Blue

f. DC Common – White with blue stripe

g. Intrinsically Safe Wiring - Light Blue

h. Foreign Voltage – Yellow

C. Control Panel Loss of Power

1. Each control panel containing a PLC shall have an input configured to alarm the operators upon loss of main control panel power. Display alarm on SCADA nodes to alert operators that attention is required.

2. Provide control panels containing a backup PLC for wetwell level control with an input configured on the main PLC to alarm operators upon loss of backup PLC power.

D. Control Panel Overcurrent Protection

1. Overcurrent protection devices: properly sized to protect associated devices and loads.

2. Circuit breakers: sized to protect associated equipment and provide necessary power to operate.

3. Fuses

a. Glass fuses not associated with motor circuit protection or inductive loads: specified as fast-acting style. Fuses associated with motor circuit protection or inductive loads: specified as time delay style.

E. Lightning/Surge Suppression

1. Provide to protect control panel and associated equipment from surges on incoming power circuits, or those induced by lightning strikes and propagated along signal or power lines connected to control panels. Surge protection: sized properly for intended purpose.

2. 120 VAC Surge Suppression

a. Provide incoming 120 VAC power source for control panel with surge suppression located in the control panel. Provide surge suppressors with auxiliary contact, connected to PLC to indicate surge suppressor failure. If there are multiple circuits within the same control panel, provide each incoming 120 VAC power source with surge suppression.

3. Analog Signal Surge Suppression

a. Supply analog signals connected to equipment or instrumentation located outside the building where the control panel is installed with DIN rail mounted surge suppression in control panel. Provide surge protection at both ends of signal cable and mount surge protection as close to equipment, instrument, or termination point as possible. Provide minimum of 10 kA surge current suppression.

4. Telephone Line and Ethernet Surge Suppression

a. Provide copper-based telephone lines and Ethernet cabling connected to control panel that leaves the building that houses the control panel with surge suppression in the control panel. Provide surge protection at both ends of telephone or Ethernet cabling and mount surge protection as close to termination point as possible.

F. Selector Switches, Pushbuttons and Pilot Lights

1. Provide for the enclosures in accordance with Division 16.

G. Uninterruptible Power Supplies

1. Provide control panel containing PLC with an uninterruptible power supply (UPS) sized to provide minimum of 10 minutes of power in event of main control power loss. Provide at minimum, UPS with relay contact outputs, connected to the PLC to indicate UPS fault and UPS low battery conditions.

H. Ethernet Switches

1. Configure ethernet switches to accept number of connections shown on Drawings.

2. Provide ethernet switches with minimum of 20 percent spare RJ-45 ports available for future expansion.

I. Seal Fail and Motor Temperature Relays

1. Pumps, mixers and other equipment equipped with proprietary seal fail and motor temperature relays, require relays to be mounted in the SCADA control panel. Seal fail and motor over temperature alarm contacts: connected to PLC as discrete inputs.

J. Intrinsic Safety Barrier Panels

1. Mount intrinsic safety barriers required for interfacing with equipment and instruments located in a classified area, in panel separate from control panels.

2. Panels housing intrinsic safety barriers: laid out to facilitate separation of hazardous and non-hazardous wiring. Wireway containing hazardous area wiring: clearly indicated.

K. Equipment Mounting/Arrangement

1. Mount components in a manner that permits servicing, adjustment, testing and removal without disconnecting, moving or removing any other component. Mount components on inside of panels on removable plates, not directly to enclosure. Mounting: rigid and stable unless shock mounting is required by manufacturer to protect from vibration. Identify components with plastic or metal engraved tags attached with drive pins adjacent to each component, identifying the component in accordance with the Drawings and Specifications.

2. Install exterior panel mounted equipment with suitable gaskets, faceplates, and other measures required to maintain NEMA rating of panel.

3. Provide minimum of 1-1/2 inches between panel wireway and terminal blocks for easy access to wiring.

4. Maintain manufacturer recommended spacing around panel-mounted equipment.

5. ISA-RP60.3 Recommended Practice: used as a guide in layout and arrangement of panels and panel mounted components.

L. Nameplates

1. Furnish panels and panel devices with nameplates identifying panel and individual devices with the following.

   a. Device tag number: as shown on Drawings.

   b. Functional description

   c. Functional control description

2. Furnish 3/32-inch thick, black and white, Lamacoid nameplates with engraved inscriptions, unless escutcheon plates are specified or noted on Drawings. Letters: black against a white background. Edges of nameplates: beveled and smooth. Affix to panels using #4-40 threaded stainless steel button head hex screws.

3.02 INSTALLATION AND MOUNTING

A. Location of control panel shown on Drawings is approximate. Obtain information relevant to process control placement Work in the field. Exact location: approved by Owner or Engineer during construction. In case of interference with other Work, proceed as directed by Engineer.

3.03 MAINTENANCE AND SPARE PARTS

A. Extra Materials and Spare Parts: as specified below. Make interchangeable with and of same material and workmanship as corresponding original parts.

B. Control Panel Spares: one of each type of the following.

1. Surge protector

2. Power supply

3. Radio Modem (IP router for licensed spectrum radio)

4. Fuses (minimum 10 percent spares of each type)

C. Programmable Logic Controller Spares: one of each type of the following

1. PLC processor

2. I/O module

3. Memory module

3.04 FIELD QUALITY CONTROL

A. Provide in accordance with Division 01 General Requirements.

3.05 STARTUP & COMMISSIONING

A. Provide in accordance with Division 01 General Requirements.

B. Power up SCADA Panel upon delivery to Owner.

C. Power up control panels upon installation. Test field wiring for proper termination. Analog signals: simulated for a full scale 4-20mA test.

D. Provide testing of SCADA system with Integrator after installation of control panels and instruments, and termination of field wiring to panels is complete. Start up and testing: witnessed by Owner.

3.06 CLOSEOUT ACTIVITIES

A. Provide in accordance with Division 01 General Requirements.

END OF SECTION